met: finishing

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Vol. 6 No. 70 (New series) OCTOBER, 1960

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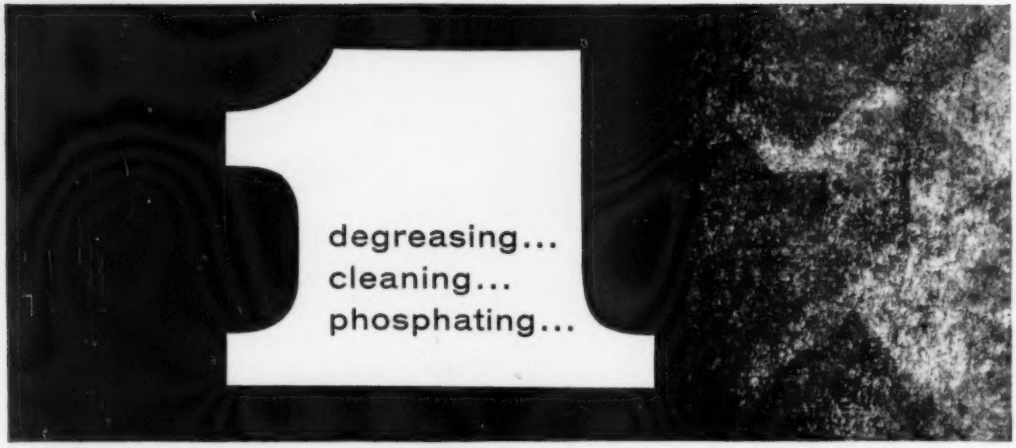

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metal finishing Journal

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THIS JOURNAL IS DEVOTED TO THE SCIENCE AND TECHNOLOGY OF PAINT APPLICATION, ELECTRODEPOSITION, VITREOUS ENAMELLING, GALVANIZING, ANODIZING, METAL SPRAYING & ALL METAL FINISHING PROCESSES. THE EDITOR IS PREPARED TO CONSIDER FOR PUBLICATION ANY ARTICLE COMING WITHIN THE PURVIEW OF "METAL FINISHING JOURNAL" AND ALL SUCH ARTICLES ACCEPTED WILL BE PAID FOR AT THE USUAL RATES.

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PRAY SILENCE . . . .

HISTORY bears no record of the name of the man who was responsible for planning the programme and organization of the first technical conference ever held in this country, but whoever he was, the traditions which he initiated and the pattern which he established have endured with little change to the present day as his lasting memorial. The technical sessions with their abundance of lantern slides, the preprints of papers, which never seem to arrive until the last possible moment ; the civic receptions, sponsored by the ratepayers in the hope that the organizers will bring their conference and their custom back to that foresaken Spa or out-of-season resort ; the cocktail parties, at unearthly hours of the day and night ; all these have become only too familiar features of the conference programme. And then, the conference dinner and the speeches. Ah, those speeches ! What if the room grows hot and the seats grow hard, while the air thickens with the smoke of a myriad cigarettes and the subdued chatter in the corner rises menacingly in volume—this is the speaker's brief hour of glory. A captive audience of some hundreds on whom he can unleash the full flood of his wit and rhetoric, while he expounds his cherished bigotries unchallenged and rides his hobby horses without hindrance. Outside, the ballroom floor lies sleekly deserted and the band sips beer and awaits its call, while those who should be enjoying the dancing (the cost of which has been included in their conference ticket) sit uneasily chair-bound what time the flood of elocution trickles on its inexorable way.

There are, of course, those whom to hear as speakers, either after dinner or at any time, is a sheer delight, but how few is their number compared with that of those who have nothing to say and insist on saying it at length.

This however, is how the pattern has been set and how it has persisted, until now recognition is slowly creeping in that the majority of those present at a conference dinner, having spent much of the previous two or three days in serious technical discourse, would much rather round off the occasion by dancing or with idle conversation in the bar than by being subjected to streams of oratory.

It is perhaps indicative of the enlightened and progressive thinking which is to be found within the metal finishing industry that the first moves towards breaking with established practice should have been made by Institutes serving those industries. Both the Institute of Metal Finishing and Institute of Vitreous Enamellers have announced that formal speeches will no longer be a feature of the culminating social function of their annual conferences and that only a few brief words of welcome from the chairman will halt the progress from the table to the dance floor. Furthermore, recognizing that formal dinners do provide a useful and welcome opportunity for those engaged in that industry to foregather and entertain guests, both these Institutes have decided to hold such a function on an occasion separate from the annual conference.

These are decisions which we can heartily applaud. Formal dinners held in a major industrial centre can provide a most acceptable platform for a leading industrialist, scientist or parliamentarian, whose words carry weight and command a hearing. The status of those attending can be commensurate with the level of the occasion and an invitation to attend as a guest can be highly acceptable. It is to be hoped that this departure will find ever widening support.

Talking Points

by "PLATELAYER"

TOPICAL COMMENT FROM THE MAIN LINES AND SIDE LINES OF METAL FINISHING

NICKEL FROM HEAVEN

THE new nickel deposits now being mined should go a long way towards ensuring that the plating industry will not have to face another nickel shortage for a long time to come. If it should be necessary to find more nickel, however, recent researches on the accretion of cosmic dust to the earth should be reassuring. This dust, which consists largely of iron and nickel, comes to us from outer space and can be measured and analysed by samples from the bottoms of the oceans, from the snow at the poles or by filtering it out from large volumes of air at very high altitudes. At such locations, contamination by ordinary dust of terrestrial origin is unlikely.

It seems, as a result of these investigations that some 5 million tons of cosmic dust fall on the earth's surface every year, of which about 2½ per cent is nickel. In other words, something like 100,000 tons of nickel is falling on to the earth from outer space free of charge — enough to keep the plating industry going even to the new British Standard specifications.

Of course, if anyone should attempt to gather it on his own ground, my calculations show that the figures would look much less attractive. In fact the total nickel he would get would amount to 1/250th of an ounce per acre per thousand years !

CLEANING-UP OPERATION

THE introduction of chromium-plating, with its high internal stress in the nineteen-thirties led to a complete overhaul of the methods used for the cleaning of metals prior to nickel plating. This was essential in order to obtain the required degree of adhesion to prevent the nickel from peeling off when chromium plating was carried out. Now, a similar re-assessment is taking place on the subject of the cleanliness of engineering components and assemblies even when no subsequent finishing operation is to be carried out. Where a sketchy wash in paraffin was, until comparatively recently, considered adequate, much more elaborate pressure washing equipment is now being installed in many cases, particularly in the motor industry.

Air conditioning and filtration is becoming almost commonplace and this tendency will undoubtedly continue to grow : some precision-engineering shops are beginning to look like operating theatres. Ultrasonic methods, which give the highest degree of cleanliness which is feasible in industry today, but are relatively dear to instal, were first used in the watch trade. They are now being applied to the cleaning of larger and less costly items. The guided missile industry is one of the most important users of ultrasonic cleaning equipment, and in fact it is doubtful if the required degree of reliability could be achieved without it.

Engineering production seems to be entering into a new era of " spit and polish."

INVENTORS PLEASE NOTE

'THE road to Carey Street," said Lord Chandos in his recent Messel lecture to the Society of Chemical Industry, " is paved with good inventions." This remark led us to ponder over the number of recent inventions in the metal finishing industry which, if they have not exactly led their sponsors into bankruptcy, have at any rate not made much money for them — so far as it is possible to judge, of course.

Among those that spring to mind are some of the thermal diffusion and mechanical plating processes. Another is tin-nickel plating, which is a non-proprietory process in the sense that it was developed by the Tin Research Institute and can therefore be freely used by anyone who so desires. This also seems to have found its level in the industry and the same applies to tin-zinc alloy plating.

It does appear that the merit of an invention is secondary to the energy devoted to the marketing of it, and this applies as much to metal-finishing processes as to Coco-Cola.

WORK-STUDY ?

AS in other fields there are fashions in industry too. The popular thing now is to go in for work-study, which is only a new name for what used to be called time study. But " time " is a naughty word in factories, as it may conjure up a vision of stop-watches.

The term work-study is used very hazily by people who seem to have no idea of what it means. A typical example occurs in a recent report on large economies effected in the Army by the application of work-study. Among those mentioned is a reduction in the cost of mowing lawns, which was achieved partly by using direct instead of contract labour and partly by the application of chemicals to reduce the rate of growth of the grass. Very commendable indeed — but certainly not work-study !

THE INSTITUTE OF VITREOUS ENAMELLERS

Report of Annual Conference and "Confair" Held at the Grand Hotel, Birmingham,

September 28 to October 1, 1960

THE 26th Annual General Meeting of the Institute of Vitreous Enamellers was held prior to the Annual Conference at the Grand Hotel, Birmingham on September 29, 1960, with Mr. J. Nicholls, Chairman of Council, presiding. The Chairman opened the meeting by extending a welcome to all members present and particularly those from overseas.

Following the formal approval of the Minutes of the previous Annual General Meeting, Mr. Nicholls presented his report on the activities of the Institute and its Committees during the preceding year. In the course of this he referred to the valuable work being done by the Local Sections in providing a continuing forum for the discussion of various practical aspects of enamelling. The Bulletin, which was the principal channel of communication between the Institute and its members, was now a monthly publication, and this was a development which would, he was sure, meet the general approval of members, although it had up to the present put a considerable strain on the resources of the Institute.

The more important technical work of the Institute was carried out through the activities of the Technical Committee under the chairmanship of Mr. J. W. Gardom, and the fruits of the deliberations of at least one of its sub-committees were available in the form of a final report which was to be discussed at one of the Sessions of the Conference on the following day. Other work was continuing and further reports would be forthcoming from time to time. The Literary and Awards Committee, with Mr. John Hooper as chairman, had arranged for the papers to be presented at the Conference on the following day, and this committee was currently engaged in planning the technical programme for meetings in 1961 and 1962. In this connexion the chairman of the Committee or the Secretaries of the Institute would always be happy to receive offers of papers for consideration for inclusion in a conference or Section programme. That Committee was also charged with the responsibility of making recommendations to Council in relation to the presentation of the various Institute Awards, and he was happy

A top-table group at the Conference Banquet. (Left to right) Mr. J. W. Gardom (past president, I.V.E.) and Mrs. Gardom, Mr. W. S. Grainger (President I.V.E.) and Mrs. Grainger, Mrs. J. Nicholls and Mr. J. Nicholls (Chairman of Council, I.V.E.), Mrs. G. R. Shotton and Mr. G. R. Shotton (President of the Institute of British Foundrymen).

Mr. S. W. Vickery (Chairman of the Vitreous Enamel Development Council) and Mrs. Vickery with the President of the Institute and Mrs. Grainger.

●

Dr. L. H. A. Pilkington (President of the Society of Glass Technology) and Mrs. Pilkington at the Presidential Reception, prior to the Conference Banquet.

to be able to announce that a presentation of both the Grainger Medal and the Biddulph Award would be made later in the programme.

The relations of the Institute with the public at large as well as with its members and the development of the Institute's activities in the interests of its members were the prime responsibilities of the Development and Public Relations Committee, under the chairmanship of Mr. John Hooper. This Committee had continued during the year to put recommendations before Council concerning ways of improving the Institute's services and functions and a number of these had been and were being implemented.

One change which, for administrative and other reasons was being made in the Institute's annual programme, was the severance of the Annual General Meeting from the occasion of the Annual

Two authors of papers presented at the Conference in conversation with the Secretary of the Institute; (left to right) Mr. A. N. Revell (Main Enamel Manufacturing Co. Ltd.), Mr. B. Pugh (T. and C. Clark and Co. Ltd.), Mr. G. E. Charlish (T. and C. Clark and Co. Ltd.) and Mr. J. D. Gardom (Secretary, I.V.E.)

(Left to right) Mr. G. Buchanan (Balbardie Ltd.) Hon. Secretary of the Scottish Section, Mr. P. Duff (Escol Products Ltd.), Mr. R. R. Fyfe-Smith (Smith and Wellstood Ltd.), and Mr. A. H. Symonds (Ferro Enamels Ltd.).

(Left to right) Mr. J. Lamont (Escol Products Ltd.), Mr. H. Barrans (Rustless Iron Co. Ltd.), Mr. G. Keep (Escol Products Ltd.), Mr. P. Rogers (Wilson and Mathiesons Ltd.), Mr. D. Smith (Benjamin Electric Co. Ltd.), Mr. N. F. Parker (Stewart and Gray Ltd.), Mr. W. Thomas (Thomas and Vines Ltd.), and Mr. S. Hallsworth (Cannon Industries Ltd.).

A group of overseas visitors (left to right) Herr F. Oberlander and Ing. E. Messmer (Württemburgische Metallwarenfabrik), Dr. K. H. Arnold (Bayer A.G.) and Dr. L. Merker (Max-Planck-Institut fur Silikat-forschung).

(Left to right) Ing. E. Messmer (Württemburgische Metallwarenfabrik), Commander G. Clarke (Vitreous Enamel Development Council), Mr. E. W. B. Dunning (North Thames Gas Board), Mr. A. W. Murdoch (Ferro Enamels Ltd.), Mr. I. W. Murdoch (R. and A. Main Ltd.), and Mr. B. Pugh (T. and C. Clark Ltd.).

(Left to right) Mr. W. Paton and Mr. M. C. Patrick (Borax Consolidated Ltd.), Mr. B. B. Kent (B. B. Kent Ltd.), Mr. G. Keep (Escol Products Ltd.), Mr. M. F. Ball and Mr. G. L. Hudson (Borax Consolidated Ltd.).

Mr. J. Buciewici (Head of the Chemistry Division of the Foundry Research Institute in Poland) in conversation with Mr. J. H. Gray (Escol Products Ltd.) and Mr. F. Wilkie (Tipton Enamel Ltd.).

Conference. It was proposed in future to hold the annual general meeting during the first week in October in each year in a major industrial centre such as London or Birmingham, and to stage a formal Dinner in conjunction with the meeting. This would provide an excellent opportunity for members to entertain guests at an Institute function, and the chairman expressed the hope that all members would welcome the change and give their support to the new function.

The Chairman then referred to the Education Committee of which Mr. J. H. Gray was Chairman and which had as its main objective the organization of the Annual Enamelling School sponsored by the Institute. He regretted that a number of circumstances had made it necessary to postpone the 1960 School which was to have been held earlier that month, but it was hoped that it would be possible to hold it during February 1961.

Looking ahead for the moment, Mr. Nicholls announced that the 1961 Conference of the Institute would be held in Harrogate in May and in the Autumn of that year the first International Convention held under the aegis of the International Enamellers Institute would be held in Venice.

Concluding his report, the chairman expressed the sincere thanks of the Council to all the chairmen and members of general committees and section committees who gave so freely of their time and energies to promoting the interests and aims of the Institute, and he paid tribute also to the work of the Secretary on whom the burden of Conference organization, as well as day to day administration, principally fell.

The Chairman then called on the Hon. Treasurer, Mr. W. S. Grainger, to present the financial report for the preceding year. This revealed that the year's activities had resulted in an excess of expenditure over income of over £600, which was a reflection of the greater activity of the Institute and its committees and of the increased publishing programme of the Bulletin. The Honorary Treasurer observed that close attention was being paid to the Institute's financial position and it was hoped that it would be possible to eliminate the deficit without affecting the direct services to members. The report was adopted.

The next business on the Agenda was the election of a President and here the Chairman called on Mr. J. W. Gardom, as the senior vice-president present, to speak on behalf of the Committee of past presidents. Mr. Gardom said that nominations for election to the office of President of the Institute were put forward by the Committee of past presidents, which had in the past sought to enlist the interest of persons of industrial or academic eminence rather than those directly concerned with the vitreous enamelling industry. On the present occasion, however, it had been decided to make a departure from precedent and to recognize the many years of honorary and enthusiastic service accorded to the Institute by Mr. W. S. Grainger by nominating him for election to the highest office in the Institute, and he had great pleasure in putting this nomination before the meeting. Mr. Grainger's nomination was supported unanimously and with acclamation.

The election of Mr. Grainger as president made it necessary for him to relinquish the office of Honorary Treasurer and in his stead Mr. J. W. G. Pedder was unanimously elected to this office.

The formal business of the meeting concluded with the announcement of the result of the ballot for the election of three members of Council. Those elected were Mr. John Hooper, Mr. T. J. MacArthur and Mr. A. W. Murdoch.

Presentation of Awards

The Literary and Awards Committee had recommended to the Council the presentation of two of the three awards which lie in the gift of the Institute.

The Grainger Medal presented for notable technical or other services to the Institute was awarded to Mr. A. W. Murdoch and in making the presentation Mr. W. S. Grainger said that the Council was happy to recognize in this concrete form the many services which Mr. Murdoch had rendered the Institute and particularly the Midland Section on repeated occasions.

The second presentation made on this occasion was the Biddulph Award and this medal was also presented by its donor, Mr. A. Biddulph. In making the presentation, Mr. Biddulph said that he was particularly pleased that the presentation of the Award had been recommended for a second year in succession. As in the previous year the Medal had been offered to the member who submitted the best critical review of the programme of the Institute's Annual School, and in presenting the Medal to Mr. H. D. Moore he congratulated him on the standard of his contribution.

Presidential Address

Following his election as President, Mr. W. S. Grainger delivered a short Presidential Address, in the course of which he reviewed the events leading up to the creation of the Institute of Vitreous Enamellers and recalled some of the personalities who had played a leading part in its formative years. The Institute had made a major contribution in breaking down the suspicions and jealousies which existed between different companies in the industry. He looked forward to the time when the valuable work being done by the Institute would receive even wider recognition, he was fully confident that the joint efforts of the Institute and the Vitreous Enamel Development Council, with which it enjoyed a close association, would continue to be of growing benefit to the industry.

(*Continued in page* 391)

THE I.V.E. "CONFAIR"

IN conjunction with the I.V.E. Annual Conference a "Confair" was held in the Grosvenor Room and Gallery of the Grand Hotel, Birmingham. This small trade fair was open throughout the conference and provided suppliers of goods and services the opportunity of exhibiting their products to their customers. Designed and organized by Feller-Fours Ltd., the Confair consisted of sixteen stands, three of which were devoted to technical journals, including "METAL FINISHING JOURNAL," interested in the field of vitreous enamelling. A general impression of this small exhibition can be obtained from the photographs on the facing page, which show some of the stands and a general view (photo 4). A brief description of exhibits is given below :

Laporte Titanium Ltd.

Two years ago, Laporte Titanium introduced the Tiona V grades especially for use in vitreous enamels. These readily-soluble, free-flowing grades have been well received by the industry and the demand for them is growing. Development of improved methods of control of the quality of production enables three grades of constant, but different, colour tones to be produced. The consistency in quality of production which has been achieved was demonstrated along with other special features of the three types, Tiona VC, Tiona VN and Tiona VB.

The Staveley Iron and Chemical Co. Ltd. 3*

New this year, in the range of alkaline cleaners covering the varied requirements of the industry, are non-foaming cleaners. They have been produced to keep up with the trends of development in equipment and are individually formulated to meet the practical problems encountered in obtaining a correct balance between maximum wetting and grease removal and minimum foam formation.

There is a close connexion between the vitreous-enamelling industry and another Staveley product, machine-cast pig iron which, produced in high, medium and low phosphorus grades, is supplied to founders throughout the country for the production of castings which include washing machines, grates, domestic boilers, baths and cookers.

Spencer and Halstead Ltd. 8

This stand showed, mainly by photographs, shot-blast cleaning plant suitable for the vitreous-enamelling industry. A cut-away model of the latest Centriblast multi-bladed impeller wheel assembly was on display to show the construction and easy maintenance of this unit. Various other items including dust-exhaust equipment and fan engineering products in general were illustrated.

British Titan Products Ltd. 7

Titanium-oxide-based enamels have excellent opacity far in advance of other types. Thus brilliant whites may be produced from thinner coats, giving a corresponding increase in resistance to thermal and mechanical shock. The use of titanium oxide also confers a degree of acid resistance, which cannot otherwise be obtained without loss of enamel workability.

Besides these properties, tioxide granular adds the further advantages of uniformity and cleanness of tone in white and tinted enamels, essential to modern mass production methods.

The exhibits demonstrated these points and gave a brief insight into some of the chemical and physical considerations which have enabled B.T.P. to produce a grade of titanium oxide to satisfy present-day colour requirements.

Borax Consolidated Ltd.

"More ideas begin with Boron" was the theme of the display stand of Borax Consolidated Ltd., which depicted the sources and some of the numerous world-wide applications of boron products. A particular feature was an illustration of one of the famous "20 Mule Teams" formerly used for transporting boron ore from mines in Death Valley, while another illustration showed the open-pit borate mine at Boron, California. The side panels showed the principal end uses of boron products in industry, agriculture and chemical research. Also included on the stand were samples of some of the many boron products supplied by the company, together with a selection of current technical literature.

The Incandescent Heat Co. Ltd. 5

The Incandescent Heat Co. Ltd. showed, by displays and photographs, the steps by which the Jetube vitreous-enamelling furnace has been evolved. Commencing with the oil-fired muffle furnace, the display illustrated how the first batch-type Equi-Radiant furnace was developed, followed by continuous furnaces on the same principle. These furnaces in turn have given place to the Jetube fired furnace which was introduced barely a year ago. Already six continuous and two batch furnaces have been built or are on order. This system is claimed to give high flexibility of oper-

*Numbers refer to illustrations on facing page

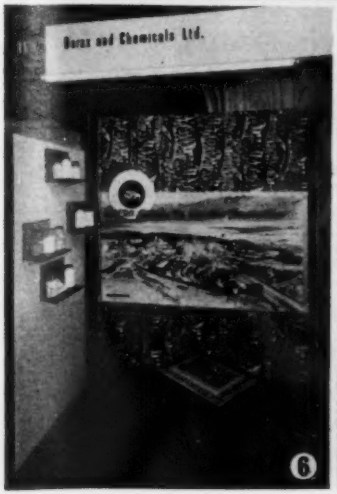

The Aerograph - Ballotini Co. Ltd.
Whiter than White!
1


TILGHMANS
PITLESS
PLAIN
ROTARY
TABLE
PLANT
2


Stanley Iron and Chemical Co. Ltd.
New
A RANGE OF EFFICIENT
NON-FOAMING FORMULATIONS
FOR SPRAY WASHING
3


The Institute Vitreous Enamellers
4


5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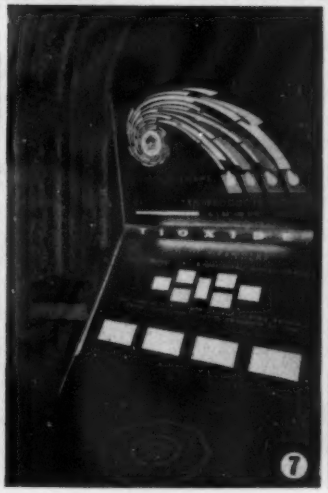

7


Spencer and Halstead Ltd.
8

ation, consistency of quality and volume of output. The operating principle of the Jetube was shown on the stand, together with photographs of recent installations.

Metalectric Furnaces Ltd.

Metalectric vitreous-enamelling furnaces and allied plant have established the advantages which electric heating can give in many enamelling works throughout the world. The first Metalectric electric fusing furnace was installed over 20 years ago and is still giving highly economic and trouble-free service.

In association with Metal Porcelains Ltd., Metalectric can offer an efficient service in modern application and fusing techniques with equipment, the designs of which stem from a wide knowledge of the industry and long experience in thermal engineering in general.

Photographs of some of the Metalectric equipment supplied to the vitreous enamelling industry were displayed, including batch and continuous furnaces with associated handling equipment.

Metal Porcelains Ltd.

Metal Porcelains Ltd. manufacture a complete range of vitreous-enamelling frits, including ground coat, cover coat, acid-resisting and titania self-opacified frits ; low temperature frits, white, black, transparent and acid-resisting for wet-process cast iron, and white frit for dry-process cast iron. Current investigations include improved chip resistance by the development of one-coat low-temperature fusing enamels for sheet steel, and the adaptation of high-opacity thin-application enamels for use with cast iron. A complete range of detergent-resisting enamels and enamels for use with aluminium sheet is now available. All the company's products were featured on the stand.

Controlled Heat and Air Ltd.

Controlled Heat and Air Ltd. has for many years supplied equipment for vitreous enamelling, especially spray booths and drying ovens. On display were photographs of typical plants ranging from simple spray booths to totally-enclosed, high production automatic spraying plants, with Max Fabric dust collectors.

Many types of drying oven are designed for batch and continuous operation and the company build high-speed air circulation dryers using direct gas-fired heaters, steam or electricity, or indirectly heated by oil. Special attention is given to fuel economy, and in some cases waste heat from the fusing furnace is used for drying the sprayed ware.

Mill Room Accessories and Chemicals Ltd.

Latest developments in firing jigs for box furnaces and continuous furnaces were featured. The tubular perritts in particular have found favour in electrical furnaces where heat preservation is all important. Their weight in some cases is less than half of the conventional cast perritt. The correct choice of alloy and the welding technique employed assure maximum life and minimum cost.

Also shown was the Steatite range of mill linings and balls, selected pebbles and pot mills. Among the latter are the special closure type which are said to have a marked advantage over the older type. The Rotamix which is used for the recovery of overspray enamel was a new addition to the exhibits of this company.

Borax and Chemicals Ltd. 6

Borax and Chemicals Ltd. exhibited the well known range of Three Elephant brand boron products including Pyrobor, V-Bor, borax and boric acid manufactured by their parent company, American Potash and Chemical Corporation. The anhydrous form of borax offers economies over the hydrated forms of borax in the smelting process. V-Bor (pentahydrate borax) and the common decahydrate form of borax were also shown on the stand. Also exhibited were the lithium ores from the mine operated by Bikita Minerals (Private) Ltd., near Fort Victoria, Southern Rhodesia. Borax and Chemicals Ltd. are the sole selling agents in the U.K., Sterling area and Europe for the Bikita lithium ores which include Petalite, Spodumene, Lepidolite, Amblygonite, and Eucryptite, all of interest to the enamel manufacturer as economical sources of lithia. A recent new product from Bikita is Pollucite (containing approx. 25 per cent caesium oxide). Caesium is the most reactive of the alkali metals, and when more is known of the effects of caesium additions to enamels, Pollucite may prove to be another valuable raw material for the enamel manufacturer.

Tilghman's Ltd. 2

This company have, for many years, supplied the enamelling industry at home and overseas with shot-blasting equipment designed to suit individual requirements. For high production rates, the airless centrifugal throwing wheel plant is recommended, while for smaller output a shot-blast room or hand cabinet is usually employed. Work handling features vary considerably, some of those in more common use today being rubber belt conveyor, plain rotary table, multi-table, overhead conveyor, and more recently, a horizontal roller conveyor plant designed for cleaning bath tubs prior to enamelling.

There appears to be a growing interest in the industry for the abrasive cleaning of aluminium parts prior to enamelling. This can be achieved with the use of special non-metallic abrasives, and

(*Continued in page* 391)

I.V.E. " Confair "

(*Continued from page* 390)

tests recently carried out in Tilghman's laboratories have proved extremely satisfactory. The company also manufacture an extensive range of air compressors and are specialists in dust and fume equipment.

The Aerograph—De Vilbiss Co. Ltd. 1

A spray gun used for vitreous enamelling is the Aerograph-De Vilbiss Type JGA provided with stainless-steel fluid passages to eliminate any risk of staining the material. A nitralloy fluid tip and needle is fitted to eliminate wear by the abrasive vitreous material. Good atomization of the enamel at low air pressure is effected by means of a newly designed No. 705 air cap, thus providing, it is claimed, considerable saving of material, cleaner worker conditions and reducing overspray to a minimum. Type JGA spray gun is fitted with a one-quart suction feed cup or can be connected by hose to a pressure feed tank for which, when used, the company's Type R.A.M. air motor is recommended. This motor imparts a strong reciprocating action to a three-bladed paddle which ensures that every particle of the material in the tank is kept in motion thus maintaining a constant density throughout the enamel.

For mass-production work where articles are to be enamelled at the rate of thousands an hour, Aerograph-De Vilbiss rotary and transverse action automatic spray coating machines are available.

The company also provide a free advisory service, without obligation, on all aspects of vitreous enamelling.

Sismey and Linforth Ltd.

This stand highlighted the fact that the company have had 25 years of experience as designers and builders of box and continuous enamelling muffles, static and rotary enamel smelters, fired by producer gas, town gas and oil. The gas-fired muffles incorporate ceramic refractory tube recuperators. The oil-fired muffles incorporate waste-heat recovery apparatus to provide hot air both for oil atomization and for delivery to driers. The smelters are fitted with heat-resisting steel recuperators, reducing fuel consumption by 20 to 25 per cent. New designs are also available for enamelling cast iron, sheet steel and aluminium and for enamelling furnaces without muffles fired by L.P. gases. All the anciliary equipment necessary to these installations can be supplied.

I.V.E. Annual Conference

(*Continued from page* 387)

Works Visits

In the afternoon of September 29 members were provided with the opportunity of visiting one of three works, Cannon Industries Ltd., Bilston Foundries Ltd., and Valor Ltd. Each of these visits was fully supported and the parties were made most welcome by the various companies. In the evening members participated in a Michaelmas Dinner at the Regency Club, Shirley, followed by dancing and Cabaret.

The following day, Friday, September 30, was devoted to technical sessions at which six papers, including the report of the sub-committee on " Abrasion Resistance of Enamels " was presented and discussed.

The final Conference Banquet on the Friday evening was attended by three hundred members and guests, presided over by the President of the Institute, Mr. W. S. Grainger. The toast of the Institute of Vitreous Enamellers and the British Enamelling Industry was proposed by Mr. W. T. Wren, past president of the Institute, in his capacity of President of the International Enamellers Institute. Mr. W. S. Grainger responded. The toast of the guests was put in characteristic style with a wealth of black country humour by the Chairman of Council, Mr. J. Nicholls, and the response was given by Dr. L. H. A. Pilkington, president of the Society of Glass Technology.

As a final and most enjoyable occasion on Saturday morning members of the Institute were given the opportunity to visit the works at Wombourn of Ferro Enamels Ltd. (who this year celebrate their Silver Jubilee) and after spending an interesting morning watching the manufacture and control of enamelling frits, the party was entertained most royally to luncheon under the genial chairmanship of the Ferro Managing Director, Mr. S. W. Vickery.

Death of Mond President

THE Directors of The Mond Nickel Company announce with deep regret the death of their President, Mr. George Archer, on Tuesday, September 20.

Mr. Archer was appointed President in July 1960, having been Chairman of the Company and its subsidiary, Henry Wiggin and Company Ltd. since July 1959. He joined the board of Mond in 1948, became Sales Director in 1952 and Managing Director in 1955. In 1945, in recognition of his services in various Government Departments, he was appointed a Companion of the Order of St. Michael and St. George.

Letters to the Editor

• "Metallizing Steel Wire in Molten Aluminium"

SIR,
We should like to correct a misleading statement which appeared in the introduction to the article entitled—"Metallization of steel wire by immersion in molten aluminium"—in your August issue. The author is a Czech and no doubt he was generalizing from conditions in his own country when he stated that it was necessary to develop ways to save zinc because of the general shortage of zinc. In fact, outside the Sino-Soviet bloc there are adequate supplies of the metal available and no difficulties are foreseen in meeting the steadily growing demands for it.

Czechoslovakia itself has only a small zinc production but the Sino-Soviet bloc as a whole is a net exporter and so any shortages there must be the result of restrictions imposed to increase the bloc's ability to earn foreign currency. In recent years the Russians have several times claimed to hold the largest resources of zinc in the world and there is little reason to doubt these claims.

Zinc certainly is not scarce and there is no prospect of users having difficulty in obtaining all the metal that they require in the future.

Yours etc.,
R. Lewis Stubbs.

Director,
Zinc Development Association,
London, W.1.

IT was realized that the author's statement regarding supplies of zinc referred to conditions in his own country, but it was considered that this was so apparent that it was not necessary to emphasize that this was so. However, we are grateful to Mr. Stubbs for his explanation of the conditions existing within the Sino-Soviet bloc.—Ed.

• "Complete Paint Finishing Systems"

SIR,
In the August, 1960 issue of "*Metal Finishing Journal*" a statement appears that claims that for the first time in this country a complete paint finishing system can be installed by a single organization.

I would point out that the Carrier Engineering Organization has provided a comprehensive service for the past 35 years, and this goes beyond the sequence of operations extending from metal pretreatment to final colour-coat stoving. The organization's barrel to body service has been in operation for a considerable number of years and there are many installations in existence both in this country and abroad.

Tours etc.,
J. A. E. Heard.

Director,
Carrier Engineering Co. Ltd.,
London, S.W.1.

FORTHCOMING CORROSION AND METAL FINISHING EXHIBITION

THE Corrosion and Metal Finishing Exhibition which is to be held in the Empire Hall, Olympia from November 29-December 2, will be opened by Sir Alexander Fleck in his capacity of President of the Society of Chemical Industry.

This year the Exhibition will be probably the world's largest display of anti-corrosion and metal finishing products and services. Over 100 stands will be open to visitors and experts from such organisations as the Atomic Weapons Research Establishment (A.E.A.), the Department of Scientific and Industrial Research (D.S.I.R.), and the Tin Research Institute will be available to answer visitors questions on corrosion in their respective fields.

Official support is backed by symposia arranged by the Plastics Institute and the Corrosion Group of the Society of Chemical Industry who will occupy the Empire Restaurant on the afternoons of Tuesday, November 29 and Thursday, December 1, respectively. Papers to be read and discussed at the Plastics Institute Symposium are "Protective Packaging—Engineering Applications" (G. Gonda) "Plastics as Heavy Protective Coatings" (N. Vinson), and "Fabricated Plastics and their role in Combatting Corrosion" (K. V. Pepper). Subjects at the Corrosion Group Symposium will be "Influence of Water Movement on Corrosion; Ferrous Materials" (Dr. G. Butler of the National Chemical Laboratory) and "Influence of Water Movement on Corrosion; Non-ferrous Metals" (Dr. N. V. Nowlan of the Admiralty Materials Laboratory). The symposia are, of course, open to visitors.

Film shows will be held on three of the four days. The varied programme covers corrosion, metal pretreatment, coatings, etc., and is expected to be most informative for many visitors. Film titles include "Metal Spraying," "Flame Cleaning—Removing Rust Prior to Painting," "Corrosion in Action," "Must it Rust," and "No Rust Here."

ZINC COATINGS ON IRON AND STEEL

7—Tests and Specifications

A Survey

by A. K. PARKER, M.A.
in collaboration with the Zinc Development Association

(*Concluded from page* 363, *September*, 1960)

A NUMBER of important conclusions about the desirable characteristics of zinc coatings emerged from the discussion of corrosion resistance in Chapter 3. It was shown that the life of a zinc coating is roughly proportional to its weight and independent of the method of application (*Metal Finishing Journal*, 1959, **5**, pp 447-8) and that, while the incorporation of small amounts of common impurities in zinc had no recognizable effect, uniformity of thickness, or the lack of it, had a marked effect on the life of the coating.

It is also essential that the zinc should adhere satisfactorily to the basis iron or steel as otherwise it will flake and fail to protect the underlying surface. If zinc-coated steel has to undergo mechanical deformation during fabrication, the coating needs to be sufficiently ductile not to crack or break away from the basis metal when the bending strains are applied.

Thus there are four criteria which can have an important effect on the life and effectiveness of a zinc coating, *viz :* thickness (or weight), uniformity, adhesion and ductility. Practical tests for these characteristics are described in relevant specifications issued by the British Standards Institution and the American Society for Testing Materials, but before going on to discuss these, it is useful to consider what information may be obtained from simple visual inspection of a zinc coating.

VISUAL INSPECTION

Simple visual inspection is of great importance in assessing the quality of hot-dip galvanized coatings, more so perhaps than for other types of zinc coating.

Hot-dip Galvanized Coatings

These should be continuous and free from uncoated areas such as " black spots " resulting from improper pickling or other faulty procedure. Although zinc will protect such defective areas sacrificially, it can only do so at the expense of other parts of the zinc coating, with an overall reduction in the life of the coating. Electrolytic protection should therefore be regarded as the second line of defence against corrosion, the first being the presence of a complete coating of zinc sealing the basis metal from the atmosphere. Tiny pores in the coating, however, have no adverse effect on the performance of zinc coatings because of the stifling effect of the zinc corrosion products.

The coatings should appear smooth and free from all lumps, blisters and inclusions of dross, flux or other foreign matter. Smoothness and evenness of a coating are useful indications of uniformity — at any rate, it is fairly certain that a rough coating is far from uniform. Flux inclusions are particularly undesirable as they accelerate the corrosion of the coating, while inclusions of dross or zinc-iron alloy crystals tend to cause brittleness.

Many hot-dip galvanized coatings exhibit a characteristic spangle or crystalline appearance. Although this is often decoratively attractive, it must be emphasized that the spangle bears no relation to the real protective value of the coating.

Because galvanizing is a hot process, it may bring to view defects in the basis metal which are not always visible at room temperature[1]. Examples are the black lines due to rolling seams, formed by non-metallic inclusions during rolling, blisters in the root of an angle caused by the defect of " piping " during rolling, unevenness resulting from laminations produced during rolling and the unsightly stains caused by pickling acid seeping out from incompletely sealed welded joints. A very useful series of coloured photographs showing the appearance of these and other defects which may arise in galvanized structural steelwork has been published[1].

Zinc Sprayed Coatings

These are always slightly rough but they should, of course, be of uniform texture and free from all lumps and coarse areas. Although uncoated patches can readily be detected by visual inspection, it is not possible to tell whether the operator has

made the requisite number of passes over the whole surface without more rigorous tests.

Zinc-plated Coatings

Visual inspection can reveal little more than "black spots" or blisters.

TESTS FOR COATING THICKNESS

Five types of test for measuring the thickness of zinc coatings on iron or steel are specified in British and American standards. Table VI indicates their suitability or otherwise for testing particular types of zinc coating. The tests are :

(a) Weighing before and after application of the coating ;
(b) Microscopic measurement of an etched cross-section ;
(c) Stripping tests in which the coating is removed from a given area ;
(d) Drop and jet impingement tests, in which the time to penetrate the coating is measured ;
(e) Magnetic and electromagnetic methods.

Of these tests, types (b), (d) and (e) measure local thicknesses while types (a) and (c) measure the mean weight of coating over the whole area of the sample. There is also an important distinction between types (a) and (c) and the others, in that whereas the magnetic, electromagnetic and simple weighing tests are non-destructive, the remainder involve destroying or damaging the zinc coating on the test-piece. Such tests must therefore be carried out on pieces cut from the finished product ; while this is usually possible with sheet and wire, it is rarely possible with fabricated articles, so the practice is sometimes adopted of zinc coating separate test-pieces along with the main articles. This practice is definitely not to be recommended as it is almost impossible to ensure that the zinc coatings on the test-pieces are identical in thickness with those on the articles themselves. Where damage to the zinc-coated product is forbidden, therefore, it is better to rely solely on non-destructive testing methods. The methods will now be considered individually :

(a) Weighing an article before and after applying a zinc coating provides a very direct method for determining the total amount of zinc on it. The mean thickness of the coating can then be calculated if the total surface area is measured. While it is quite easy to do this for an article of simple shape, it is tedious and difficult to do it for complex articles, incorporating threads etc.

In relating thickness and weight of coating, it is useful to remember that a zinc coating of 1 oz. per sq. ft. has a mean thickness of 0.0017 in.

(b) Direct measurement of the thickness of the zinc coating on a cut and polished section by means of a microscope is a simple method for determining the local thickness of electro-deposits. The end of the specimen is ground and polished and then etched with a solution of chromic acid and sodium sulphate to increase the contrast between the zinc and the basic metal. The measurement is made with a filar micrometer ocular or a projection microscope.

(c) In stripping tests, the total weight of zinc on a sample test-piece is determined by weighing it before and after removing the zinc coating. If the area of the test-piece is known, the average thickness of the coating can readily be calculated. The usual stripping solutions consist of antimony trioxide in hydrochloric acid, though hydrochloric acid may sometimes be used alone ; the antimony inhibits attack on the basis steel.

A variation of this type of test, which is suitable only for electroplated coatings, consists in measuring the amount of electric current which is required to deplate the zinc coating from a known area using a standard electrolyte[2]. A high order of accuracy is claimed for the method.

(d) The local thickness of coatings of pure zinc may also be determined by measuring the time it takes for a standard jet of liquid or stream of drops to penetrate through the coating to the basis metal. The tests are unsuitable for use on zinc coatings incorporating alloy layers, as the rate of solution will not be constant in such cases.

Fig. 54.—B.N.F. Jet Test apparatus.
(Courtesy of British Drug Houses Ltd.)

In the B.N.F. jet-test, a jet of a standard solution of ammonium nitrate and hydrochloric acid is delivered at a constant standard pressure from a glass jet of standard dimensions onto the specimen, which is set at an angle of 45 deg. to the horizontal, and the time taken for the jet to penetrate the zinc coating is measured[3]. The thickness of the coating is read off a calibration chart, the accuracy of the method being about ± 15 per cent. The apparatus is shown in Fig. 54. If the zinc coating has been passivated, the article should be immersed in 5 per cent acetic acid, rinsed, scoured with a little magnesium oxide, rinsed again and then dried before the test is carried out. The method is simple and rapid and, although it destroys the zinc coating at the point of test, it does not harm the basis metal so that stripping and replating is always possible.

The drop test is similar in principle to the B.N.F. jet-test, with the jet replaced by drops of a standard solution of chromic and sulphuric acids, falling onto the specimen at a controlled rate (100 ± 5 drops per minute). The number of drops required to perforate the coating is recorded and the thickness read directly off a calibration chart.

(e) Magnetic and electromagnetic thickness meters make use of the fact that zinc coatings on iron or steel comprise a non-magnetic coating on a magnetic base. The meters measure either the attractive force between a magnet and the coated specimen or the reluctance of a flux path through the coating and the basis metal*. The use of such meters is specified in various standards, though these draw attention to certain difficulties which accompany the use of these instruments.

The measurement is affected by the curvature of the article at the point of test in relation to the size, shape and strength of the magnetic pole and also by the distance from the test point to the edge of the article. Ideally, measurements should be made well away from the edge of fairly large flat specimens. Some difficulty is found in zeroing the instruments when measurements are made on rough surfaces, either of the coating or of the basis metal, and also on hot dip galvanized coatings containing alloy layers. Frequent calibration checks on flat smooth surfaces of known thickness are therefore necessary.

Under suitable conditions, an accuracy of ± 10 per cent is obtainable with most commercial instruments. Because magnetic testers do not damage either the coating or the basis metal, they are excellent for the rapid routine testing of finished products, destructive methods being used to check their accuracy.

The methods available for testing each particular type of zinc coating are given in Table VI, which also gives references to the British Standards and A.S.T.M. specifications in which each test is quoted.

Table VI

Test	Type of Coating			
	Hot-dip Galvanized	Zinc Sprayed	Zinc Plated	Sherardized
Weighing before and after coating	A	A	A	P
Microscopic measurement of cross-section	Unsuitable	A	P (ASTM A 219) (4)	Unsuitable
Stripping Tests	P (BS443) (5) (ASTM A90) (6)	P	P (BS1706)(7)	P
Drop or Jet Impingement Tests	Unsuitable	Unsuitable	P (BS1706)(7) (ASTM A219) (4)	Unsuitable
Magnetic or electromagnetic meters	A (ASTM A 386) (8)	P (BS2569)(9)	A (ASTM A219) (4)	A

Preferred Methods P
Alternative Methods A

TESTS FOR UNIFORMITY

A zinc coating of given weight will be most effective in combating corrosion if it is evenly spread over the surface to be protected. One method of testing uniformity is to measure the thickness of the coating at a large number of different points, but a simpler method, which shows up the thinnest parts of the coating, is generally used. This is the Preece test or its modification, the B.S.I. copper sulphate test[10].

In this, a sample of the zinc-coated material is immersed in a neutral solution of copper sulphate at a temperature of 60°-70° F. for one minute and then withdrawn. Loosely adherent copper is removed by rinsing and brushing and the sample dried before being immersed for a further minute. This procedure is repeated for the number of dips specified in the Standard or contract or until brushing fails to remove the copper, showing it to have been deposited on the basis iron or steel.† What the test aims to do, in effect, is to strip the coating at a uniform rate and so reveal those parts which are thinnest.

The test is a very useful one for giving a rapid indication of uniformity, or the lack of it, but it must be stressed that it is not intended as a method of thickness determination or for comparing one type of coating with another. The rate at which

* A list of manufacturers of commercial instruments is available on request to the Zinc Development Association

† When the test is carried out on a sherardized coating, the coating may appear a chocolatey colour which should not be mistaken for a deposit of copper.

the copper-sulphate solution dissolves the coating depends on the composition and structure of the coating, zinc-iron alloys being found to dissolve at only about half the rate of pure zinc[11]. Because of this, it is useless to compare a sherardized coating, which is wholly zinc-iron alloy, with an electroplated coating, which contains no alloy at all ; nor should it be used to compare two galvanized coatings produced by different processes and therefore of different composition. As the proportion of alloy layers to pure zinc varies with the angle of a corner on a galvanized article, the test is unsatisfactory for testing the uniformity of zinc coatings on threads etc.[12].

Again, the test should only be used on freshly prepared samples as the oxide layer, which forms on atmospheric exposure, is not easily dissolved by copper sulphate so that an altogether erroneous impression of the effectiveness of a coating is obtained[12]. Phosphate coatings affect the test similarly.

The B.S.I. issues separate specifications for applying the copper sulphate test to wire [5] and to other articles[10].

TESTS FOR ADHESION

Simple methods of testing the adhesion of a zinc coating to the basis metal are described in British and American Standards. Various attempts have been made to devise quantitative tests but none has so far proved to be entirely satisfactory.

Hot-dip Galvanized Coatings

Adhesion of zinc coatings on wire is tested by wrapping the wire around a mandrel, the diameter of which is usually specified as being so many times that of the wire. The wire is deemed satisfactory if none of the zinc coating can be removed by rubbing with the bare fingers when the wire is unwrapped[14].

To test adhesion on flat galvanized surfaces, other methods are employed. In one of these, it is specified that light hammer blows should not cause peeling of the coating adjacent to the area deformed by the hammer blow[15]. In another, the coating is deemed adherent if, when it is cut into with a stout knife applied with considerable pressure in such a way as to tend to peel off the zinc coating, none can in fact be removed[9].

Zinc Sprayed Coatings

In the method for testing adhesion of coating specified in the British Standard for sprayed zinc coatings[9], two parallel lines are cut through the coating by means of a hardened steel scriber, at a distance apart equal to ten times the average coating thickness ; if any part of the coating between the lines breaks away, it shall be deemed

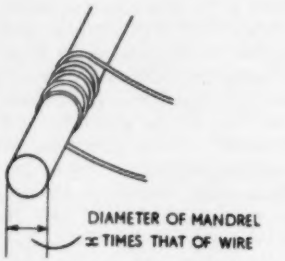


Fig. 55.—Adhesion test for galvanized coating on wire.

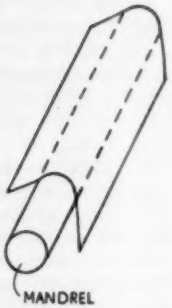


Fig. 56.—Ductility test for galvanized sheet.

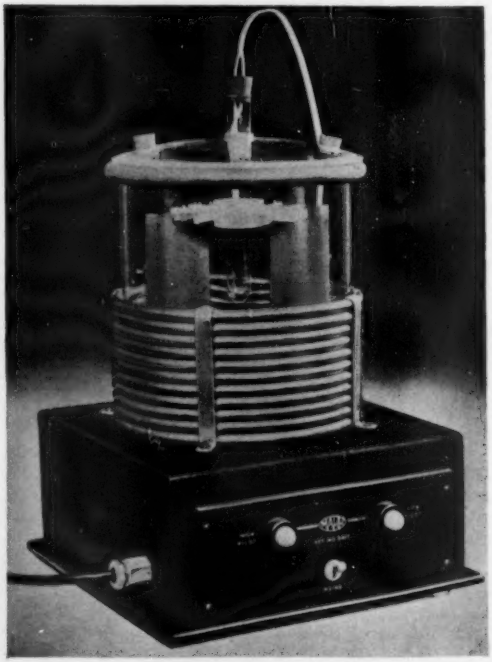
to have failed the test. This method is not entirely satisfactory as it does not invariably reveal poor adhesion in a single test.

Zinc-plated Coatings

A slightly different method again is specified in the British Standard for electroplated zinc coatings[7]. A small area is rubbed with the edge of a copper coin or similar object so as to burnish but not cut the coating ; poor adhesion will be shown

(*Continued in page* 403)

Fig. 57.—C.R.L. sulphur-dioxide test apparatus.
(Courtesy of J. B. Marr and Co. Ltd.)



FLAME SPRAYING OF ALUMINIUM OXIDE

By DWIGHT G. MOORE*

(A paper presented to the colloquium on "Metal Spraying" at the Annual Assembly of the International Institute of Welding)

Introduction

ALTHOUGH the metallizing of parts by flame-spraying has been practiced for many years, the application of ceramic oxides to metals by the same type of operation is a relatively new development. Oxide coatings of such materials as alumina and zirconia, when flame sprayed, not only have high melting points, but also are hard and erosion resistant and, if applied heavily, they provide a thermally insulating layer for the metal. Potential uses of the coatings include protecting metals and alloys in rocket nozzles, jet engines, and in some types of nuclear reactors.

A current research programme at the National Bureau of Standards is aimed at investigating the basic principles that govern the formation of these oxide coatings. The research work was initiated in 1958 under the sponsorship of the Wright Air Development Division of the United States Air Force. The present paper presents some of the study. In all cases, aluminium oxide was the sprayed material.

Flame Spray Guns

Two types of flame-spray guns were used, a rod type[1] and a powder-type.† Both guns were operated within the range of pressures and flow rates recommended by the manufacturer. The flame in each gun was oxyacetylene ; however, in the case of the rod gun, air at 80 lb. per sq. in. was introduced at the nozzle to increase particle acceleration.

Size and Velocity of Particles

The average particle size of collected samples was determined with a microscope in accordance with ASTM Tentative Recommended Practice for Analysis of Microscopical Methods (E20-51T).[2] The average diameter of particles from the rod gun was 6.4μ ; from the powder gun, 13.4μ.

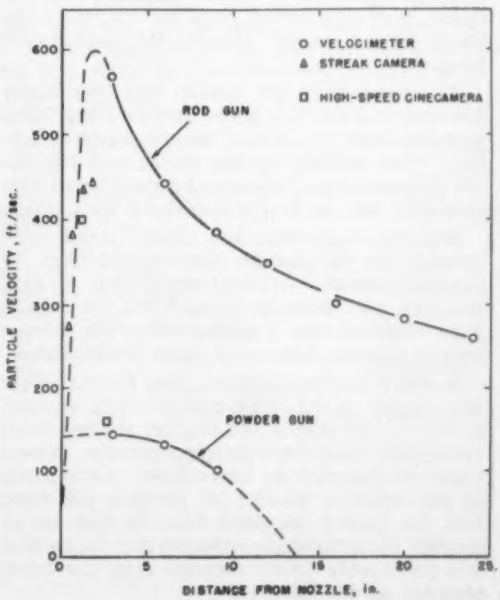
Particle velocities were determined by (1) a high-speed cinecamera, (2) a streak camera, and (3) a specially designed rotating-disc velocimeter.[3]

The cinecamera pictures were taken at 8000 frames per second on 16-mm. infra-red-sensitive film. The light source was the luminous particles themselves. Particle velocities were computed from the developed film by determining the number of frames required for the particles, which registered as short streaks on the film, to travel from the gun nozzle to the surface of the substrate (metal base). The average velocity obtained by this method for each gun is included in Fig. 1.

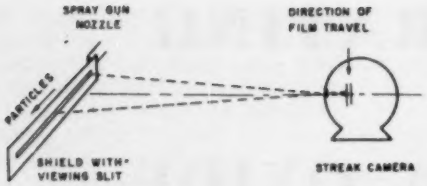
The streak camera determinations were made with a 16-mm. Fastax‡ camera from which the

‡Manufactured by Wollensack Optical Co., Rochester 21, New York.

Fig. 1.—Alumina particle velocity plotted against distance from nozzle.



* National Bureau of Standards, Washington, D.C.
† Manufactured by the Metallizing Co. of America, 3520 W. Carroll Avenue, Chicago 24, Illinois.



(a) RELATIVE POSITIONS OF GUN, SHIELD, AND STREAK CAMERA

(b) TYPICAL SECTION OF EXPOSED FILM

Fig. 2 (a)above—Schematic diagram for determining the particle velocity with a streak camera. (b) (right)—Typical section of exposed film.

rotating prism had been removed. The film moved at right-angles to the direction of particle movement ; the speed with which it moved through the camera was approximately 120 ft. per sec.

The relative positions of spray gun, shield, and camera are shown in Fig. 2a. Timing marks, shown in Fig. 2b as white spots near the lower edge of the film, were imposed on the film by a light source actuated by a 1000 cps signal. Velocities of the particles at specific distances from the nozzle were determined from the slopes of the traces formed on the film by the incandescent particles.

The flame from the powder gun was highly luminous and this luminosity prevented individual particles from registering on the streak-camera film. This difficulty was not encountered with the rod gun and a large number of particle bursts were recorded. Fig. 2b is typical of one of these bursts.

Both the cinecamera and streak camera films showed that the particles were ejected from the rod gun in bursts. At a feed rate of $6\frac{1}{2}$ in. per min. and with $\frac{1}{8}$-in. diameter alumina rod, the average burst duration was 1 millisecond ; the average interval between bursts was about 6 milliseconds.

A typical velocity-distance curve for one of the faint streaks on the streak-camera film is included in Fig. 1. In general, the brighter streaks, which presumably represented the larger particles, showed lower velocities than the faint streaks. Comparison of the observed number of particles per burst with the number calculated from the feed rate of material through the gun indicated that the smallest and presumably fastest particles were not being recorded on the film.

A third method of measuring particle velocity involved the use of the rotating-disc equipment pictured in Fig. 3 and shown schematically in Fig. 4. When the rotating disc (*see* Fig. 4) is flame-sprayed with particles, the narrow metal strip attached to the disc casts a "shadow" in the coating deposit that is formed on the glass microscope slides. The expression relating the offset of this shadow to average particle velocity is:

$$V = \frac{2RsD}{d}$$

where :

V = average velocity of adhering particles.
R = radius of disc at point of measurement.
s = speed of disc in revolutions per second.
d = distance from outer face of strip to face of glass slide.
D = distance from centre of shadow at zero disc velocity to the centre of shadow at velocity, s.

The curves resulting from measurements made with the rotating disc equipment are plotted in Fig. 1. The shape of the curve for particles from the rod gun is similar to that obtained by Matting and Becker[4] for 0.86 carbon steel sprayed from a wire-type gun.

Particle Fluidity in Spray

No satisfactory method has been devised up to the present time for measuring accurately the temperature of the small, high-speed particles from flame-spray guns. However, it was found that much can be learned about whether or not the droplets are above or below their melting temperature after any given travel distance by permitting the particles to strike the surface of glass slides. The slides are of the type used for microscopical examinations. They are mounted in an upright position at increasing distances from a rigidly fixed guide-rod, placed at the front of a spray-booth. In collecting a sample, the nozzle of the flame-spraying gun is placed on the guide-rod and the gun is moved manually across the booth at

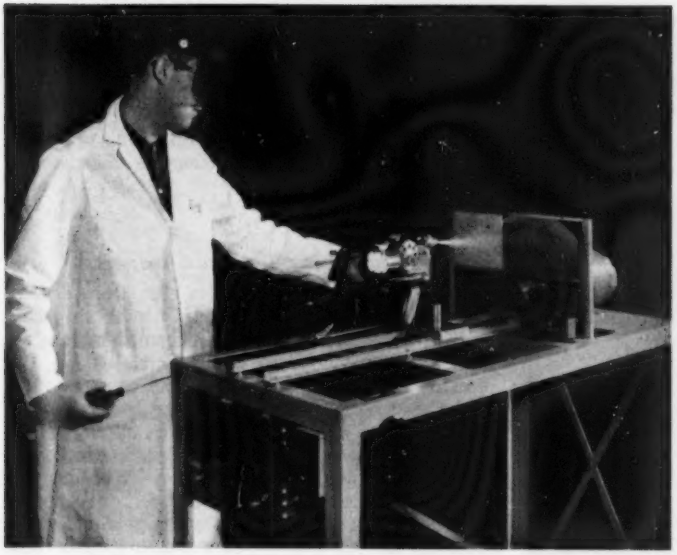


Fig. 3.—Rotating-disc velocimeter with rod-type gun.

the rate of about 3 ft. per sec. As the gun moves, the alumina particles strike each slide in turn and either adhere to the glass surface or bounce off, depending upon their condition at the instant of impact. The slides are examined subsequently with a microscope to determine how the adhering particles behaved on impact. Because of the speed of gun movement during collection, only a small number of particles are present on each slide.

Fig. 5 is typical of the appearance of alumina particles collected from the powder-gun spray. The two particles in Fig. 5A were collected at 2 in. from the nozzle. Both have been flattened by the impact. Examination under polarized light shows the presence of alpha alumina, which is bi-refringent, in the centre regions. The outer portion, however, consists of a non-bi-refringent or cubic type of alumina (eta or gamma) which is known to form whenever molten alumina is quenched rapidly [1, 5, 6]. The presence of this eta or gamma phase on the outer regions of the flattened particle, and the alpha alumina in the interior, strongly suggests that, at a distance of 2 inches from the nozzle, the particles consisted of an envelope of molten alumina surrounding an un-melted core.

The flow patterns displayed by the particles in Fig. 5B, together with a failure to detect the presence of any alpha alumina, constitute strong evidence that the particles had reached a completely molten condition after travelling 4 inches. However, the droplets apparently cooled rapidly as they travelled beyond 4 inches because, at 6 inches, the material that adhered was found to consist of flattened spheres (*see* Fig. 5C). This observation implies that the droplets had cooled appreciably in only two inches of travel. Because of the temperature gradients incident to rapid cooling, the particles at this distance probably consisted of a solidified shell surrounding a molten core.

A few calculations were made of the freezing rates of particles in the spray. These showed that a 10-μ droplet of alumina travelling at 150 ft. per sec. would become completely solidified after

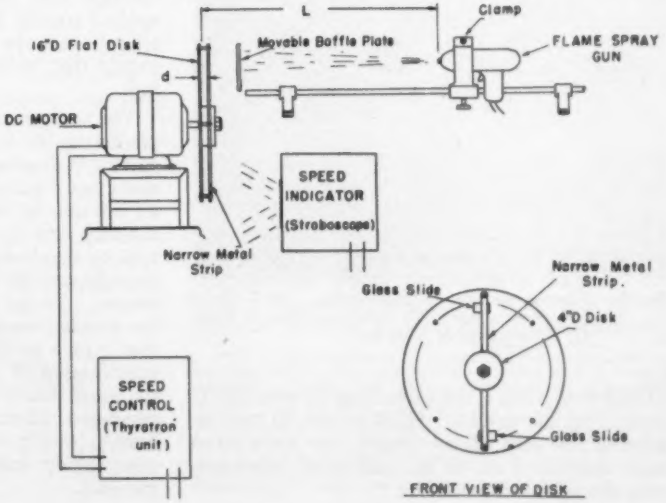


Fig. 4.—Schematic diagram of velocimeter.

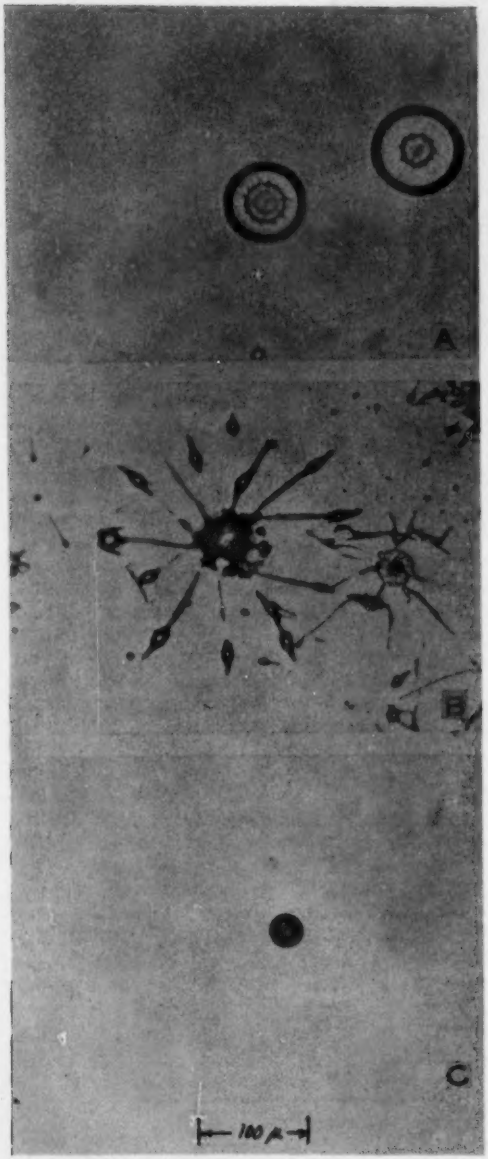


Fig. 5.—Alumina particles on glass slides. (A) Collected 2-in. from nozzle. (B) After travelling 4 inches. (C) After travelling 6 inches.

12 inches of travel if the ambient gases were 200°C. cooler than the droplet. At 14 inches, no particles adhered to glass slides, hence, the calculations were considered to be in qualitative agreement with the observed behaviour.

The higher velocity of particles from the rod gun caused a greater flow on impact than was observed for the powder-gun particles. Tests showed that although the particles in the spray from the rod gun cool more rapidly than those from the powder gun, they remain molten at greater distances from the nozzle because of their higher velocities.

Quenching Rates on Impact

Fig. 6 shows cooling curves that were arrived at by heat transfer calculations. In these calculations, the kinetic energy transformed to heat on impact was assumed to be negligible ; also, the heat supplied by the impinging hot gases was not considered. The thickness of the substrate was taken as 1 mm. ; that of a molten alumina layer that was brought into instantaneous contact with the substrate was taken as 0.1 mm. The temperature was computed for the interface. The curves as plotted in Fig. 6 are not expected to be quantitatively correct because of the assumptions used in the calculations. However, they are of interest in showing the important role played by the substrate material on the cooling behaviour of the impacting particle. According to the curve for stainless steel, the computed temperature of the alumina near the interface decreases from 2050°C. to 1800°C. at an average cooling rate of 800,000°C. per sec. ; the cooling rate on glass is 34,000°C. per sec.

The high-speed cinecamera pictures also indicated extremely rapid quenching rates on impact. For example, the molten particles from the rod gun emitted sufficient radiation to expose the film strongly just before impact upon a previously applied coating layer ; yet about 0.5 milliseconds after impact the particles had cooled to such an extent that they were no longer visible on the film.

The computed curves of Fig. 6 are helpful in predicting the flow behaviour of the particles on striking various substrates. The upper curve indicates that a small mass of molten alumina striking a glass surface can be expected to stay molten and presumably flow for about 0.03 sec. The same mass striking stainless steel would solidify in about 0.001 seconds and for platinum the time would be even shorter. In the calculations, it was assumed that the alumina was at its melting point on impact, and that it gave up all of its latent heat of fusion upon solidification at the same temperature. Most of the latent heat is absorbed by the substrate and the computed differences in time required for solidification (*see* Fig. 6) result from differences in thermal conductivity and heat capacity of the substrate material.

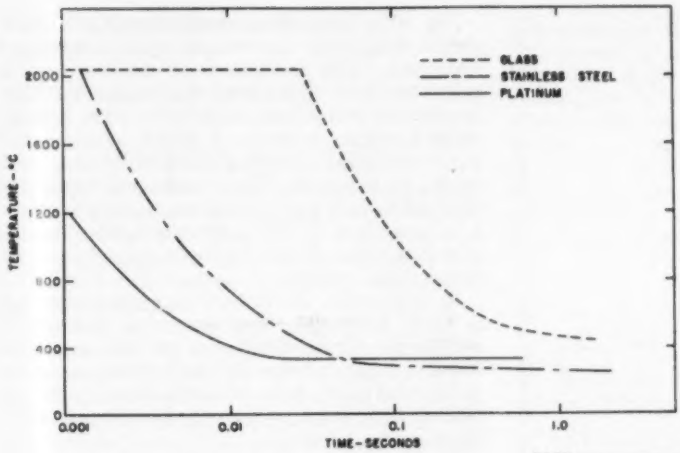


Fig. 6. (left)—Theoretical time-temperature behaviour of molten alumina. (2050°C.—assume temperature).

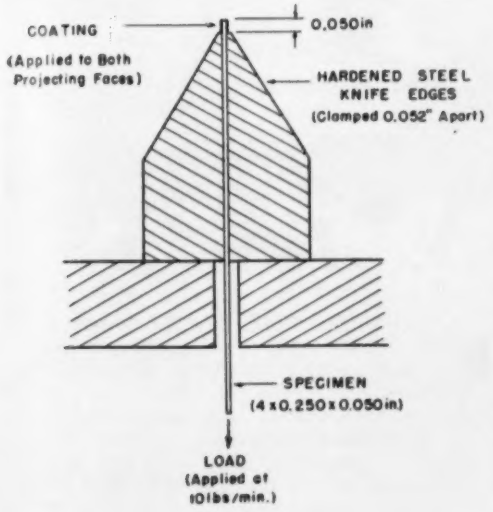
Fig. 7. (below)—Effect of surface roughness on apparent bond between alumina coating and ingot iron.

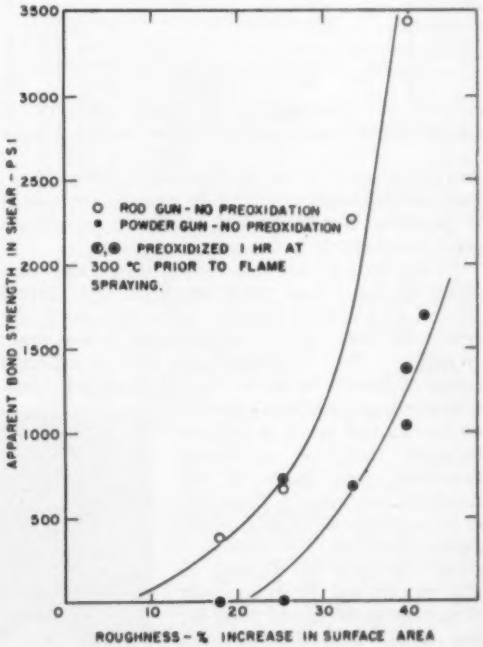
Fig. 8. (bottom, left)—Arrangement for shear strength determination.

Bond Studies

Fig. 7 shows the effect of surface roughness on the apparent bond strength in shear for alumina coatings sprayed on ingot iron. The arrangement used for determining the shear strengths is shown schematically in Fig. 8. The variations in surface roughness were imposed by controlled blasting with No. 60 silicon carbide grain. The coatings were applied at a thickness of 0.010 ± 0.001 inch. Each point represents the average for five specimens. Increase in surface roughness was determined by microscopic examination of sections taken through the interface.

The results of these measurements (Fig. 7) demonstrate the importance of a well-roughened





surface*. Because of this observation, it could be argued that the bonding of these flame-sprayed coatings was mostly mechanical in nature. The most obvious explanation is that the sprayed particles interlock with the mechanical projections

* The values plotted in Fig. 7 are apparent bond strengths in shear. To obtain the true shear strength of a chemical bond it would be necessary to eliminate both the stress concentrations and the surface irregularities in the metal. The surface irregularities tend to prevent slip at the interface when a shearing stress is applied parallel to the principal plane of the interface. Thus, on a surface with deep notches, high apparent shear strengths could be obtained even though no true chemical bonding developed between the ceramic and the metal. The apparent shear strength has a practical significance in determining the operational performance of a coating.

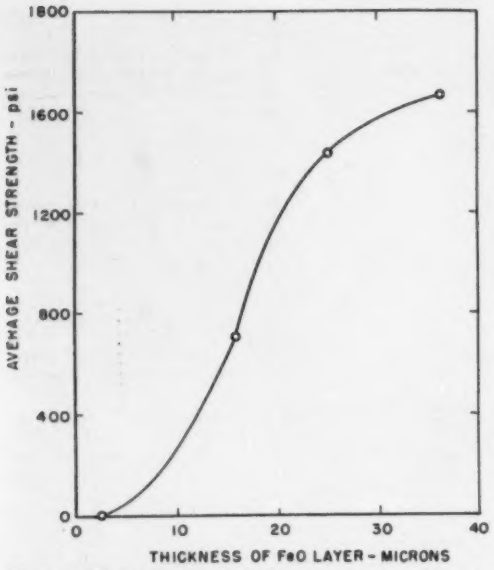


Fig. 9.—Effect of thickness of FeO layer on shear strength.

and indentations in the grit-blasted surface. However, some recent experiments have shown that it is possible, under certain conditions, to obtain good bonding to a smooth iron surface.

In the experiments referred to, shear-test specimens of ingot iron were prepared and surface ground to a smooth finish. After degreasing, the specimens were oxidized in steam for various times at 800°C. This treatment gave tightly adherent layers of ferrous oxide of varying thickness. Alumina coatings were flame-sprayed on the oxidized metal, and shear-strength tests, as previously described, were made on the resulting specimens. The effect of variations in thicknesses of the oxide layer on the measured shear strength is plotted in Fig. 9. It will be noted that shear strengths up to 1660 lb. per sq. in. were obtained even though the iron surface was initially smooth.

Fig. 10 is a typical photomicrograph of a cross-section through the interfaces of one of these coated specimens. The smoothness of the iron surface rules out any appreciable mechanical interlock between the iron and the oxide layer. The coating-oxide interface, however, is highly irregular and some mechanical gripping between coating and oxide is indicated. The oxide on specimens oxidized for only 2 minutes in steam (layer thickness 2.5μ) were free of these surface irregularities and, as shown in Fig. 9, the specimens showed no significant shear strength.

In other tests, similar specimens were oxidized at 800°C. in air rather than steam but, under these conditions of oxidation, none of the specimens developed any measurable shear strength. Also, as indicated in Fig. 7, the oxidation of iron specimens in air at 300°C. after grit blasting had no measurable effect on the bonding.

These results on the bonding of flame-sprayed alumina to oxidized iron indicate that both the type and amount of oxide at the interface may be important. On the other hand, all of the coatings tested have required a roughened interface either at the metal or at the outer part of the oxide layer for achievement of good adhesion, and this suggests that mechanical interlocking may be the controlling factor. The work completed so far is only a beginning; obviously a great deal of additional study will be required before a completely satisfactory understanding of the bond mechanism is achieved.

Concluding Remarks

The size and velocity of aluminium-oxide particles from two types of spray gun have been

(*Continued in page* 403)

Fig. 10.—Microstructure of alumina-FeO-iron substrata.

Zinc Coatings on Iron and Steel

(*Continued from page* 396)

by the formation of a loose blister which grows as rubbing is continued.

TESTS FOR DUCTILITY

Hot-dip Galvanized and Zinc-plated Coatings

Ductility tests are rarely called for on finished products, other than wire, but they are important for hot dip galvanized and zinc-plated sheet and strip which is to undergo mechanical deformation during manufacture.

The ductility of the zinc coating on wires is examined in a wrap test similar to that used to test adhesion ; lack of ductility will be revealed by the appearance of breaks in the coating and by flaking. Bend tests on a mandrel of specified diameter are also used for testing the ductility of zinc coatings on sheet and strip, the severity of the bend varying with the grade of sheet [16, 19].

CONCLUSION

The tests mentioned above are all intended for use in routine inspection of zinc-coated articles and are currently specified in one or more of the many British and American standards for zinc coatings or zinc-coated products. Many other tests have been described in the literature from time to time and a useful summary of several of them has been published by Kenworthy[17].

Accelerated corrosion tests, such as the A.R.E. salt droplet test and the C.R.L. sulphur-dioxide test[18], are intended to simulate the service behaviour of protective systems under outdoor atmospheric exposure. They are essentially laboratory tests which may take a month or longer to give results on thick metallic coatings. Even so, they cannot be regarded as a substitute for long-term tests under actual service conditions. Nor should they be used to compare the performance of totally different types of coating, and readers are warned not to accept without careful investigation the claims made regarding the performance of certain protective schemes which are better able to withstand these artificial tests than the onslaught of actual wind and weather.

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The Flame Spraying of Aluminium Oxide

(*Continued from page* 402)

measured and information has been obtained on the cooling behaviour of the particles both in the spray and on striking a substrate. In addition, some attention has been given to the bonding mechanism.

It is obvious that much additional study will be needed before the particle-impact process can be well understood. Such factors as (a) radial flow rates of particles upon impact, (b) the origin and magnitude of stresses, and (c) the effect of particle size and velocity on coating structure are all important and need to be investigated. Studies in these areas of interest are now in progress in our laboratory or are in the planning stage.

Acknowledgment

The author is indebted to Bradley Peavy of the Bureau staff for the heat transfer calculations. Also, the assistance of Warren Hayes, Alfred Crigler, and H. R. Thronton in performing the experimental work is gratefully acknowledged.

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HARD CHROMIUM PLATING OF CYLINDER LINERS

Wolverhampton Firm use specially Designed Automatic Units

FOR many years Laystall Engineering Ltd. have worked on the development of steel cylinder liners for internal combustion engines. The success achieved in this field necessitated the formation of a new company, Laystall Cromard Ltd., to specialize in the further development and mass production of "Cromard" liners. This company, now housed in newly built premises in Dixon Street, Wolverhampton, is fully equipped with special-purposes machines and includes what are probably the largest fully automatic plants to be installed for hard chrome plating the bores of liners.

The thin-wall liners are produced from deep-drawn pressings of special steel which are machined, ground, bored and lapped to micro-precision limits before reaching the point in production where the hard chrome surface is deposited in the bore.

This plating process is carried out in automatic units specially designed for the purpose by W. Canning and Co. Ltd., of Birmingham. These plants are developments of the well known "Trojan" return type design, having a short lifting section and an extended fixed carriage. The lifting section is operated by a low-pressure hydraulic system through mechanically operated valves. A rack and pinion mechanism ensures that the lift cylinders are permanently in phase and there are no flexible hydraulic connexions, pressure and return lines being telescopic tubes.

Transfer of jigs from one process tank to another is carried out by hydraulically operated traverse bars. Conveyor chains and counterbalance weights are dispensed with and the number of electrical limit switches reduced to a minimum, thereby substantially reducing possible causes of desynchronization. All hydraulic gear, traverse and transfer mechanism is carried by the steel centre structure and is operated by a power unit situated in a convenient position remote from the plant. The workarms which carry the jigs are the only parts of the plant which overhang the plating and process tanks thus reducing the probability of corrosive attack on the operating structure and eliminating solution contamination arising from oil drips. Each plant has a rated output of 40 liners per hour with 0.003 in. of hard chrome deposited in the bore and operates on a 24 hr. 6 day week basis.

The hard chrome plating process sequence is relatively simple, the actual plating section accounting for about 80 per cent of the sequence and the other 20 per cent incorporating etching, neutralizing and swills.

Before plating, the liners are first degreased and then attached to the plating jigs. Each workarm carries two jigs of special design incorporating

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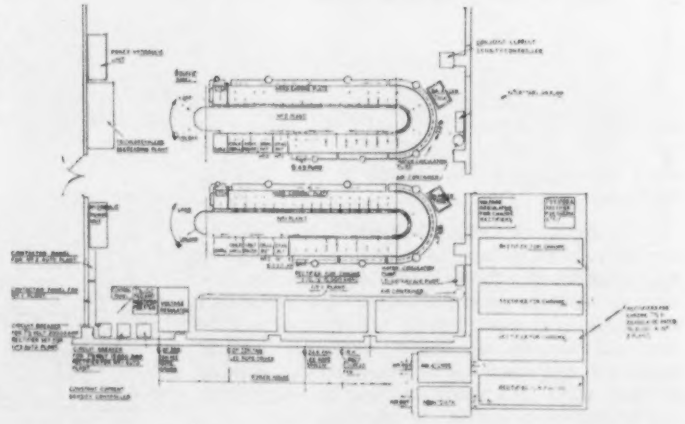


Fig 1.—*Layout of hard chromium plating plant*

Hard Chrome Plating
Cylinder Liners

(*Continued from page* 404)

fixed tubular lead anodes. The liner is placed over the anode and clamped accurately in position by the jig. To provide the necessary anodic current, a special contact track is fitted to the carriage. This is additional to the normal contact track and both anodic and cathodic currents are carried to the internal anodes and the liners *via* the jigs and workarms.

The first operation is a chromic etch and for this the polarity of the current passing to the liners is reversed. After etching, which prepares the bore surface to receive the chrome, the liners are automatically transferred to the hard chrome section. This is long enough to accommodate 60 liners in various stages of plating. During a plating time which is variable between 90 and 150 minutes, the required thickness of deposit is built up in the bore as the liners are traversed through the tank.

In order to control the heat produced by the high current densities involved when hard chrome plating on this scale, a heater/cooler has been incorporated in the design of the chrome tank. This system works on a closed-circuit principle and is automatically controlled so that the plating solution is quickly brought up to operating temperature after a shut down and then excessive heat is dissipated by an external cooling tower during normal operation so maintaining the solution at its correct working temperature.

After plating, the work passes through two "drag-out" tanks. These work on a counter-flow system using gravity flow which passes dilute solution from the second tank back to the first.

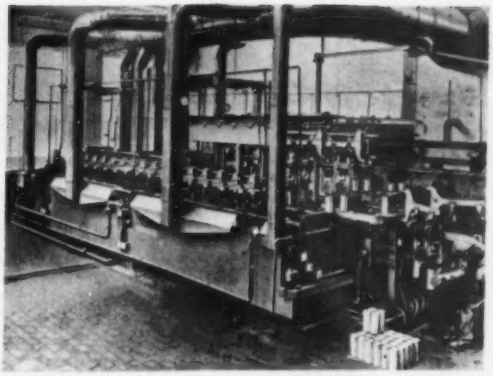


Fig. 2.—General view of hard chromium plating plant

The first tank is fitted with a transfer system for passing the concentrated "drag-out" back to the plating tank so recovering chromic acid and maintaining the solution level.

From the "drag-out" tanks the liners are transferred to an alkaline neutralizing tank and then finally to cold and hot water swills.

Current consumption for the plating process is in the order of 16,000 amp. and this is maintained under all loading conditions by automatic constant current-density control equipment. The plant process sequence is under the control of an electronic timer which permits instant variation of the process timing, when required, to increase or decrease the thickness of chrome deposited. Plating control is therefore simple and accurate and deposits are of consistent quality and uniformity with a negligible reject factor.

DESIGN FOR METAL FINISHING

New Booklet

IN the finishing of metal articles by polishing, electroplating or painting, it is possible that a great deal of time or money may be wasted because the design of the article is unsuitable for the efficient application of the required finishing process.

A new booklet outlining the essentials of design in relation to finishing processes is shortly to be published by the Institute of Metal Finishing to serve as a guide to engineers and designers. The booklet (price 5s.) handsomely produced in colour and divided into three main sections dealing individually with polishing, plating and painting, is liberally furnished with illustrations which clearly reveal the fundamental differences between good and bad design in terms of finishing requirements.

Although the book is intended primarily for designers, it is expected to prove of interest and value to many of those engaged in the finishing industry. It is therefore, available at a special price of 4s. post free to members of the Institute of Metal Finishing, and those members who are interested in obtaining a copy at the special price are invited to apply forthwith to the Assistant Secretary of the Institute of Metal Finishing, 32, Great Ormond Street, London, W.C.1.

FINISHING NEWS REVIEW

INSTITUTE OF METAL FINISHING SYMPOSIUM ON NICKEL CHROME PLATING

THE London branch of the Institute of Metal Finishing is holding a one-day symposium on Nickel-chromium plating in the Recital Room of the Royal Festival Hall, London, S.E.1., on Wednesday, November 16, 1960.

The day will commence at 9.30 a.m. with registration, followed at 10.0 a.m. by a paper, "Developments in Nickel Plating" by H. C. Castell and a paper "Recent Developments in Decorative Plating" by S. W. Baier. A buffet luncheon is arranged for 12.30 p.m. in the Lower Restaurant.

The afternoon session will also consist of two papers, one by W. G. L. Miller entitled "Acceptance requirements for Nickel-chromium Plating," and the other "Plating Acceptance Standards in Nickel-chromium Plating" by D. J. Bouckley.

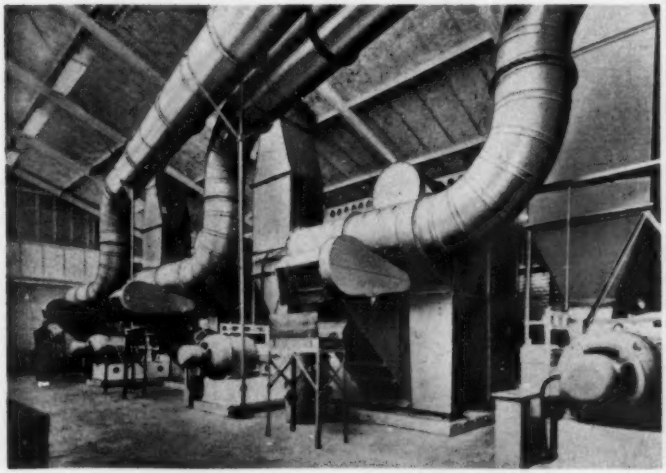
The meeting will conclude with tea at 4.30 p.m. in the Lower Restaurant.

Admission is by ticket only and a cordial welcome is extended to members of all branches of the Institute of Metal Finishing and their guests. Tickets may be obtained from Mr. S. W. Baier, hon. treasurer of the I.M.F. London Branch, 9E Cleveland Road, London, W.13 and the cost, 37s. 6d. will cover copies of the papers and refreshments.

DUST CONTROL EQUIPMENT FOR POLISHING PLANT

A COMPLETELY new factory in Sheffield for Moore and Wright (Sheffield) Ltd., the precision tool manufacturers, incorporates a large polishing department in which dust control equipment has been installed by Dallow Lambert and Co. Ltd. of Leicester.

The machines to be served were arranged in three groups so that three suction plants of identical capacity could be installed, each with a capacity of 16,000 cu. ft. of air per minute and with a fan driven by a 50-h.p. motor. A "Wet Deduster" of the Dallow Lambert patented "MG" series is upstream of each fan, the dust being discharged in the form of slurry by drag link conveyors. The fans have acoustic ducts on their discharge sides, since the location of the factory makes the noise factor of paramount importance.



ARCHITECTURAL USES OF STAINLESS STEEL IN THE U.S.A.

LECTURES entitled "Recent Developments in the Architectural Uses of Stainless Steel in the U.S.A." were given by Professor Danforth on September 5 and 6. 1960, at 66, Portland Place, W.1, supported by an exhibition of the uses of stainless steel in architecture brought from the U.S.A. The lecture was presented by the Stainless Steel Manufacturers' Association by courtesy of the Royal Institute of British Architects and was illustrated by two sound/colour films and approximately ninety slides. The lecture dealt with the case histories of five important buildings in the U.S.A. and one in Canada :—

White Castle General Offices Building, Columbus, Ohio.
The Union Carbide Building, New York.
Pottstown Hospital, Pottstown, Pennsylvania.
Gateway Centre No. 4, Pittsburgh, Pennsylvania.
The National Bank of Detroit, Detroit, Michigan.
130, Bloor Street, Toronto, Canada.

Reference was also made during the lecture to the use of stainless steel in the Empire State Building, New York, and the Chrysler Building, New York. The exhibits included scale models of buildings, actual examples of curtain wall panels, window frames and other applications in stainless steel and a range of available forms giving some indications of the workability of the metal. Sections of the exhibition dealt with the fabrication of stainless steel and the use of different surface finishes.

Professor Danforth is Director of the Department of Architecture at the Illinois Institute of Technology, Chicago, U.S.A., and is one of America's leading authorities on the uses of stainless steel in architecture and on the techniques of curtain walling.

Further lectures supported by the exhibition were given in Milan, Paris, Dusseldorf, Stuttgart and Brussels. Professor Danforth also lectured at Rome, Marseilles, Lyons, Strasbourg, Lille, Berlin, Hamburg and Munich before returning to the U.S.A. on October 15.

BRITISH CONVEYORS CHOSEN FOR SIMCA PAINT SHOP

THE system of mechanical handling for the new paint shop of the SIMCA motor manufacturing plant at Poissy, France, has been designed and installed by Geo. W. King Ltd. of Stevenage, Herts, who secured the contract in face of keen international competition.

The factors to be considered were a feed rate of 80 bodies per hour into the paint shop from a floor below, provision for two separate grades of finish at different production rates and a two-tone colour scheme. It was decided to introduce an automatic system which would call up the bodies, pass them through the various stages of process and inspection, deliver them to the trim lines and supply a flow of advance information to the forward lines preparing to call up bodies through each successive stage.

The King "Dual Duty" overhead conveyor system was employed in which the loaded trolleys, carrying items being transported, are never fixed to the moving chain, but are propelled by pusher dogs fitted to the links. This makes it possible to transfer from one conveyor line to another, storage in live-line or dead line, and the incorporation of drop sections in the systems for the transfer of bodies from floor to overhead conveyor.

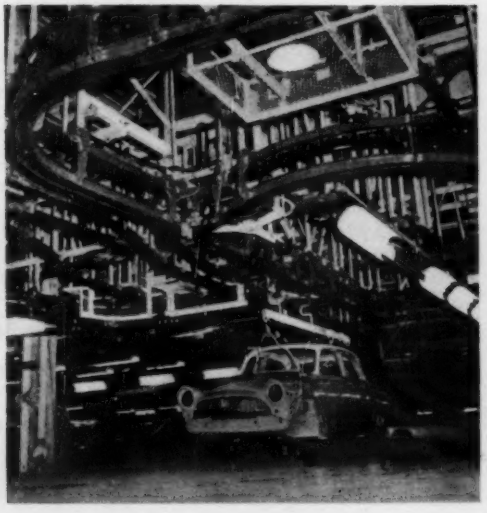
The problem of catering for two separate types of finish was dealt with by the provision of two production lines operating in parallel yet at two different speeds fed from two floor conveyors from the body shop by drop sections ; the slower line is for the luxury finish. Pre-set limit switches are provided prior to the feeding conveyor in order to distribute the flow of bodies to the two in the required sequence, and indexers are installed at various stages of the lines to act as storage in which bodies can be retained until they are required for the next process. Where it is necessary for the lines to converge in order to avoid duplication of plant and equipment, transfer units are provided, comprising rotating load wheels with transfer arms which push the load trolley along the single conveyor passing through the next stage ; transfer units are also provided where it is necessary to diverge a single conveyor line to two or more lines. The control of the transfer units is such that, used in conjunction with the indexers in which the bodies are gathered, they read the occupancy of each and take only from the most full line.

Considerable attention had to be given to timing and running speeds since while the speeds of the two feeder lines could be preset at a ratio to suit production rates, *i.e.* a maximum of 3 to 1 giving a maximum of 60 on one line and a minimum of 20 on the slower line for the luxury finish, adjustments had also to be made to suit process speeds. For instance, the spray conveyor running at the preset ratio must feed the oven conveyors at equal rates ; to meet this in the case of the first drying ovens after the application of the primer coat, each feeder line was divided into two, the capacity of the oven lines adjusted to meet the output of the spraying conveyor and a switch mechanism provided to pass bodies into the oven lines alternately and accurately.

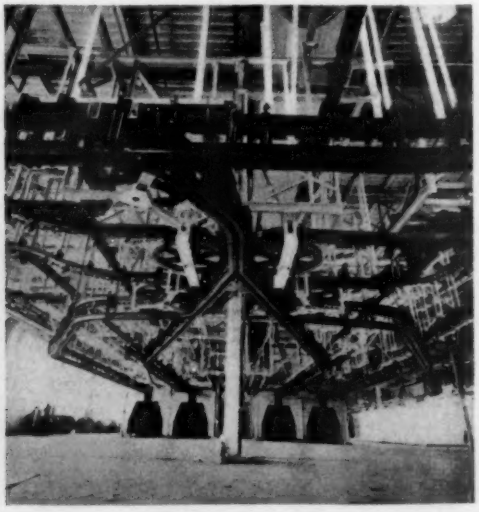
The two different finishes and consequent different conveyor speeds, as well as the two-tone colour scheme and extra coats sometimes required, demanded a very complex conveyor system in the final finishing shop, where four conveyors feed bodies to four spray-units, two handling 60 bodies per hour and two handling 20 ; transfer units break up single line flow inside each spray plant for delivery through the drying ovens, so that at the end of the drying line there are eight conveyors leaving four ovens; these are directed into two lines with the four conveyors converging through wheel transfer units.

(*Continued in page* 409)

General view of part of conveyor system in SIMCA paint shop



Four conveyor lines shown here converge into one through transfer unit



NORTHERN ALUMINIUM CHANGES NAME

Clearer Identification With Aluminium Ltd. of Canada

THE Northern Aluminium Co. Ltd., has changed its title to Alcan Industries Ltd. This new name involves no change of ownership, manufacturing activity or sales policy. Its purpose is simply to identify the company clearly as a member of the Aluminium Ltd. of Canada enterprise—"Alcan" for short.

Aluminium Ltd., with headquarters in Canada, comprises some 50 companies in more than 25 different countries, engaged in all phases of aluminium production and marketing, but the heart of the business is the use of Canada's hydro-electric power resources for the efficient smelting of the bauxite mined in the tropical countries. The company's gross fixed assets exceed $1,400,000,000 and the integrated operations they represent include the mining of bauxite and other ores on four continents; the generation of hydro-electric power; the smelting of aluminium in six countries; and the fabrication in more than 20 countries of some of the ingot into forms useful to industry. Aluminium Ltd. has sales outlets in 114 countries.

Northern Aluminium Co. Ltd. was incorporated more than 50 years ago and is Aluminium Ltd.'s principal fabricating company, converting Alcan ingot into sheet, plate, sections, forgings, castings and other forms. It is felt that there is a need today to establish more clearly the identity of the company with Aluminium Ltd., and to emphasise the advantages that the company offer customers of the considerable research and development resources within the whole enterprise, as well as of experience in the manufacture and application of aluminium in all parts of the world.

Other operating and trading companies in Aluminium Ltd. are currently changing their names for the same reasons and the common identification is the use of the name "Alcan"—symbolising "Aluminium Ltd. of Canada", and stressing the Commonwealth nature of this enterprise. Associated with the name is the recently-introduced "Alcan" mark.

The origin of the old name "Northern Aluminium," has puzzled people who know that the company has no plants further north than Birmingham; in fact, this was the original name given to the parent company when first established in Canada at the beginning of this century, was used by what was then the British sales office, and has survived here until now. The products of Northern Aluminium Co. have become well known under the "Noral" mark, and Alcan Industries Ltd. propose to continue to use this trade name.

SIMCA Paint Plant

(*Continued from page* 409)

The equipment for the automatic operation of the conveyors was designed and manufactured by the Donovan Electrical Co. Ltd., Birmingham, and the speed control is by means of Heenan and Froude variable-speed couplings. For the purpose of control, conveyors fall into six groups, each controlled from a Donovan switchboard in the control room. Drop sections for the transfer of bodies from the floor to the overhead conveyor, have separate local control panels, and "functional" control panels are provided for the various types of transfer unit along the conveyor lines. The plant operator stationed at the master control desk in the control room is able to set up the controls for the desired method of operation and to start and stop the plant at will. Facing the operator is a diagram with operational indicating lamps for all conveyors and transfer units, flanked at each end by banks of lamps for indicating abnormal occurrences of various kinds.

The control scheme has been designed to ensure operations without errors under all normal conditions, and safety circuits have been incorporated to ensure maximum safety to the personnel and to the plant under all foreseeable mechanical and electrical fault conditions.

CANNING AND DENDIX BRUSH AGREEMENT

W. CANNING and Co. Ltd. have arranged to enter into a licence agreement with Dendix Brushes Ltd. of Chepstow, England, to enable W. Canning and Co. Ltd. to manufacture and sell industrial polishing brushes impregnated to give longer life and improved operating efficiency by processes protected by the Osborn Manufacturing Co.'s British Patent No. 665095, at present operated under licence by Dendix Brushes Ltd.

INDUSTRIAL USE FOR POLYURETHANES

NEW plastics that outwear steel yet stretch like rubber were described in a paper by Charles F. Blaich, Jr. and Arthur J. Sampson, both of the Carwin Co., North Haven, Connecticut, presented at the 138th national meeting of the American Chemical Society before the Division of Rubber Chemistry. The new materials from a class of chemicals known as polyurethanes, are expected to find use in heavy duty applications such as tyres for lift trucks, skids for jet planes and gears; used as tips for high pressure air guns through which diamond dust and other abrasives are sprayed, the polyurethanes last much longer than rubber, steel, carbide or even diamond tips and their resistance to wear suggests that they could greatly extend the service life of bulldozer blades and steel mine shoots.

The compounds are made from a combination of three classes of chemical "building blocks," isocyanates, polyesters and amines. By the proper selection and proportioning of the ingredients, products can be prepared which are tougher than mild steel but which can be stretched to double their length; when the force is released they snap back to their original length. At one end of the spectrum of products that can be made are putty-like materials, and at the other end, brick hard solids; in the former, the molecules are tied together with highly flexible joints or bonds, while compounds linked together with rough, inflexible bonds produce the hard, tough, but stretchy materials. When used as solid wheels for lift trucks, it has been found that these polyurethane elastomers can support up to 20,000 pounds per wheel and have stood up for over three years where the best rubber wheels, capable of supporting 5,000 pounds per wheel, have only lasted six weeks.

HELLERMAN PHOSPHATES GIVEN MINISTRY APPROVAL

THE phosphate division of Hellerman Ltd. have been granted D. I. ARM (Inspectorate of Armaments) and I.F.V. (Inspectorate of Fighting Vehicles) approvals for their phosphating solutions. This is in addition to the Admiralty, A.I.D. (Aeronautical Inspection Dept.) approvals which have already been granted.

TECHNICAL *and* INDUSTRIAL APPOINTMENTS

Mr. J. Wortley, B.Sc., A.M.I.Mech.E. has been appointed managing director of **R. and A. Main Ltd.** Mr. Wortley joined this company at their Falkirk Works in 1948 and was transferred to Edmonton in 1949. In 1950, he was appointed assistant general manager, later becoming general manager, and in 1956 was promoted to general manager of both Edmonton and Falkirk works. He joined the board of directors of R. and A. Main Ltd. in 1958 and became deputy managing director in 1959.

Mr. Wortley has also served as a director of Main Enamel Manufacturing Co. Ltd. since 1955 and his father, the late G. W. Wortley, had been a director of the company for a number of years.

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Mr. Joel J. Shulman has been appointed Public Relations Manager to the **Pall Corporation,** Glen Cove, New York, and will be responsible for the public relations, technical sales literature, advertising and related activities. The Pall Corporation claim to be the largest producer of stainless-steel filters in the U.S.A. and Pall filters are used in wide and varied applications ranging from vehicles and jet aircraft to atomic submarines.

* * *

Mr. J. M. Mitchell (president of Alcoa International, Inc.) and Mr. M. J. S. Clapham (chairman of I.C.I. Metals Division) have been appointed directors of **Almin Ltd.**

Mr. W. Brining ; Mr. J. M. Graham (directors of Almin Ltd.) ; Mr. J. M. Mitchell, and Mr. S. W. Weysom (deputy treasurer, I.C.I.) have been appointed directors of **Imperial Aluminium Co. Ltd.**

* * *

Mr. Ralph John Assheton, M.A., has recently been appointed to the board of directors of **Borax Consolidated Ltd.** ; this is in addition to his appointment earlier this year as director of Theodore St. Just and Co. Ltd. Mr. Assheton is thirty years of age and was educated at Eton from where he won an open scholarship in Natural Science to Christ Church, Oxford where he received an honours degree in chemistry. For the last three years he has been engaged in chemical research work in this country.

Mr. J. Wortley

James H. Goss, vice-president and group executive of General Electric Co. has been elected a director of **The International Nickel Co. of Canada, Ltd.** As a vice-president and group executive of General Electric Co. with overall responsibility for the International Group, to which the company's International General Electric Co. Division is assigned, Mr. Goss also acts on behalf of his company with respect to its interest in and relations with the Canadian General Electric Co. Ltd., of which he is a director and served as its president from 1955 to 1957.

Mr. Goss joined General Electric in 1931 as a design engineer in West Lynn, Massachusetts. He subsequently transferred to Schenectady, New York, moved to Toronto in 1955 and was transferred to New York in October, 1957, when he was appointed vice-president and group executive for the Consumer Products Group. He assumed his present post in September, 1959.

Born in Paris, Arkansas, Mr. Goss received a B.Sc. in Mechanical Engineering from the University of Arkansas in 1930. He is a graduate of the Advanced Management Programme at Harvard University.

* * *

Mr. A. R. Jackson has been appointed to the board of the **Consolidated Pneumatic Tool Co. Ltd.,** of 232, Dawes Road, London, S.W.6. Mr. Jackson is general manager of the company's Australian branch and will continue in charge of operations in that country. Joining the company in Australia in 1927, Mr. Jackson was appointed general manager of the Australian branch in 1952.

RECORD USE OF VITREOUS-ENAMEL PANELS

35,000 sq. ft., of "Escol" porcelain-enamelled steel panels have been used on the new factory for Ilford Ltd., at Basildon, Essex. This represents the largest area of enamelled steel infill so far used on a single project in this country, and possibly in Europe. The unit used throughout has a honeycomb core infilled with vermiculite with porcelain enamelled steel facing and galvanized steel backing. The estimated 'U' value is 0.3. and the colours used are three shades of grey and yellow.

Escol porcelain-enamelled steel panels were selected after thorough investigation was carried out by the Basildon Development Corporation, and their clients, and followed visits to a number of completed "Escol" contracts. The panels were manufactured in their entirety by Stewart and Gray Ltd., Paisley Works, S.W.17 and associated companies, including the enamel itself by Escol Products Ltd. Other major "Escol" projects completed or in progress include the new Daily Mirror building, High Holborn (20,000 sq. ft.), multi-storey flats, Newcastle-on-Tyne (35,000 sq. ft.), the Meteorological Office, Bracknell (15,000 sq. ft.), London Road Station, Manchester (14,000 sq. ft.).

GALVANIZING TRIPLES RAIL LIFE

A NUMBER of Dutch coal mine operators are reported to be obtaining three times the service life previously experienced with uncoated steel rails by hot-dip galvanizing rails used to carry heavy ore loads. Information from the Stichting Doelmatig Versinken (the Dutch galvanizing trade association) shows that conventional steel rails formerly used in the Dutch mines became corroded and unsafe after two or three years as a result of the constant exposure to water, humidity and aggressive chemical attack, but by applying a coating of zinc by hot dip galvanizing, the rails can now be relied on for from five to six years of efficient and safe, heavy-duty service. The galvanizing consisted of a coating of from 3.2 mils to 4.0 mils of zinc, equivalent to 2-1¼ ounces per square foot and while this became eroded by friction on the bearing surface of the rail, the sides and the base which are the areas most affected by corrosion retained protection.

MEETINGS OF THE MONTH

October 17

Institute of Metal Finishing (London Branch). "Electroplating Processes; Effect on Fatigue Strength and Embrittlement of the Substrata" by C. Williams. Northampton College of Technology, St. John Street, London, E.C.1, at 6.15 p.m.

October 18

Institute of Metal Finishing (South West Branch). "Methods of Preparation for Plating," (a) "Abrasive Blasting" by R. A. Wilding at the Assize Courts Hotel, Bristol, at 7.30 p.m.

October 18

Sheffield Metallurgical Association. "Some Observations on the Austenitic Steels used for Corrosive Duties in Chemical Plant" by E. J. Heeley, A.Met., F.I.M. (I.C.I. Dyestuffs Division).

October 25

Institute of Metal Finishing (South-West Branch). "Metal Finishing in the Instrument Industry" by F. C. Carpenter. The Saracens Head Hotel, Gloucester 7.30 p.m.

October 28

Institute of Metal Finishing (Sheffield and North-East Branch) "The Electrodeposition Properties and Applications of the Precious Metals" by R. R. Banham, at the Grand Hotel, Sheffield, 7.0 p.m.

November 9

Institute of Sheet Metal Engineering (Midland Branch). "Powder Metallurgy" by B. H. Swan (Dualloy Ltd.) at the Birmingham Chamber of Commerce, Harborne Road, Birmingham, 6.45 p.m.

November 15

Sheffield Metallurgical Association. "Some Aspects of Hydrogen in Steel" by J. Hewitt, A.Met., A.I.M. (United Steel Cos. Research and Development Department.)

November 16

The North Wales Metallurgical Society. "Non-destructive Testing" by N. F. Godwin, B.Sc., A.Inst.P. at the Lecture Theatre, Flintshire Technical College, Connahs Quay, near Chester, 7.0 p.m.

FILMS

A NEW 22-minute colour film on the refinishing of motor vehicles — "Formula for Finish" was shown to the press on September 9 by Lewis Berger (Great Britain) Ltd. The film opens with a road accident involving an Austin Cambridge and follows the repair process right through to the car taking to the road again. Phases of the manufacture of new motor cars are included in the film which emphasizes the need for matching the original colours when repairing old or damaged coachwork. Also dealt with are the main features of the refinishing materials and the laboratory work essential to the production of these materials.

The film will be shown at demonstrations and discussions held all over Britain by representatives of Berger Vehicle Refinishes Division in co-operation with the company's factors. Several of these meetings are already booked for Birmingham, Bolton, Doncaster, Manchester, Newcastle, Stoke and Walsall. Four London screenings for invited guests have been arranged during the commercial and private motor shows in October and November. Readers interested in seeing the film at either a morning or evening session should write to the Industrial Sales Manager, Lewis Berger (Great Britain) Ltd., Freshwater Road, Dagenham, Essex.

EXHIBITION ON INDUSTRIAL METALS

THE Mond Nickel Co. Ltd. are presenting an exhibition of modern industrial metals at the South Wales Institute of Engineers, Park Place, Cardiff, from November 1 to 4, 1960, designed to interest all concerned with engineering problems involving the use of metals. Emphasis will be upon the properties of nickel-containing materials and platinum metals; exhibits, displays and demonstrations will be divided into seven sections—the properties of metals at high, normal and sub-zero temperatures, metals versus corrosion, metals for surface protection, metals with special magnetic, expansion or chemical properties, methods of fabrication and another section will deal with nickel and chromium plating to the new British Standard.

Lectures will be given each day at 11 a.m. and 3.0 p.m. by members of the company's development and research department and films will be shown at other times during the day.

A programme of the lectures and film showings can be obtained from the Mond Nickel Co. Ltd., 20 Albert Embankment, London, S.E.11.

BELGIAN CONFERENCE ON NON-CORRODIBLE METALS

THE Centre Belge D'Etude De La Corrosion, 24 Rue des Chevaliers, Brussels are holding a conference entitled "Stainless Steels and High Nickel Alloys in the Chemical Industry" on Thursday, October 20, 3.0 p.m. at Fabrimetal, 21, Rue des Drapiers, Brussels 5. Two papers will be dealt with, *viz.*—"Steels and Alloys resistant to Chemical Attack," by M. L. Bourge, of the Research Laboratory of the Emile Henricot works, and "Nickel-based Alloys resistant to Corrosion" by Mr. E. Ward of Henry Wiggin and Co. Ltd. of Birmingham.

Those wishing to take part in the conference should apply direct to CEBELCOR, 24, Rue des Chevaliers, Brussels, 5.

PURCHASING OFFICERS' COURSE AT DUBLIN

THE Purchasing Officers' Association have arranged a course for buyers in industrial and public undertakings at the Jury's Hotel, Dublin, on Friday, October 28, 1960. The following papers will be given: "The Selection and Training of Purchasing Personnel" by J. Murray Grammer, Director-General of Purchasing and Stores, National Coal Board; "New Developments in Purchasing" by E. Davies, B.Sc. (Econ.), P.O.A. Technical Officer; "Problems of Buying Outside Ireland" by A. E. Quin, purchasing officer, Arthur Guinness, Son and Co. Ltd., and chairman of the Republic of Ireland Branch, P.O.A.

A conference fee of 1 guinea for Association members and students and £1 11s. 6d. for non-members, includes attendance at the course, morning coffee, lunch and tea. Further details may be obtained from The Secretary, Purchasing Officers Association, Wardrobe Court, 146a, Queen Victoria Street, London, E.C.4.

TENNANT MEMORIAL LECTURE

PROFESSOR A. R. Ubbelohde, M.A., D.Sc., F.R.S., (Professor of Thermodynamics — Imperial College of Science and Technology, London) will deliver the Fifth Charles Tennant Memorial Lecture entitled "Melting and Freezing" in the Royal College of Science and Technology (Room 24), George Street, Glasgow on Friday, November 4, 1960 at 6 p.m.

All interested persons will be welcome.

Trade and Technical Publications

The sixty-fourth development report of the British Non-Ferrous Metals Research Association, entitled "An Atlas of Process Defects" sets out to illustrate the defects arising during plating processes on zinc-alloy die castings. A survey of over one thousand rejected plating castings has shown that the troubles are very often associated with the preparation of die-castings for plating and the plating process itself. In the course of the examination of this large number of rejected articles, most of the common causes of process defects have been encountered and the more important of these are described in the atlas with suggestions for their elimination. Three types of blistering, five types of pitting and several other defects are included. Some twenty illustrations, all magnified eight times, show the surface appearance of the defects as seen with the aid of a small hand lens. It is emphasized that the atlas only illustrates defects arising during the plating process, not those which may develop in subsequent service. This publication may be obtained from The British Non-Ferrous Metals Research Association, 81-91 Euston Street, London, N.W.1.

* * *

The National Coal Board, Hobart House, Grosvenor Place, London, S.W.1, have issued a booklet, "The Case for Coal," designed to appeal to industrial and commercial users who between them consume 50 million tons of coal a year. The booklet sets out to prove that Britain's indigenous fuel can be the economical answer to most industrial fuel needs and devotes a page each to industrialists, architects and consulting engineers, and to local authorities, reminding them of the most effective methods of using coal in their own particular fields ; another page explains how the Clean Air Act works. The second part of the booklet is devoted to a short but clear appraisal of the four types of mechanical stoker most commonly in use and gives guidance as to their range and suitability.

* * *

The Pyrene Co. Ltd., Metal Finishing Division, Great West Road, Brentford, Middlesex, have issued a pamphlet describing "Pyroclean No. 9," a heavy-duty alkali-type degreasing agent supplied in powder form and used in aqueous solution operated normally within a temperature range of 190-205°F.

The Incandescent Heat Co. Ltd., Cornwall Road, Smethwick, Birmingham, have produced a leaflet No. V.59 (1), entitled "Incandescent Gas Atmospheres Division — What we make," describing the range of equipment produced by them. These include gas absorbers, acid fume treatment plant, adsorption plant, air-conditioning plant, air dryers, air preheaters, ammonia dissociators and ammonia burners.

* * *

"Confidence in Plating" issued by the Mond Nickel Co. Ltd. of Thames House, Millbank, London, S.W.1. is a 60-page booklet giving an account of a conference at the Engineering Centre, Birmingham, on February 23, 1960 and in the Queen's Hotel, Birmingham on February 24, 1960, concerned with the means of producing plating to meet the British Standard 1224 : 59 so that it can carry quality labels. There are eight sections, the first three of which deal with labelling, the British Standard and the value of specifications ; section D describes the B.N.F. Plating gauge, sections E and F corrosion testing and the corrosion resistance of nickel-chromium plating, and sections G and H the care of plated parts and the effect of design on plateability.

* * *

W. Canning and Co. Ltd. of Great Hampton Street, Birmingham 18, have published the first issue of a new magazine "The Canning Journal" which contains details of developments together with articles of general interest to the metal-finishing trade. They have also issued News Sheets 6 to 11 covering abrasive emulsion, bright cyanide copper and bright nickel plating solutions, abrasive cement and metal cleaners.

* * *

The latest techniques for controlling and measuring thickness and hardness of precious electroplates, with particular emphasis on gold, are discussed in an original technical paper by Mrs. Grace Wilson, laboratory technician of the Sel-Rex Corporation, entitled "Thickness and Hardness Measurements on Gold Deposits," which was published in the June, 1960, issue of the American journal "Metal Finishing." Reprints of this paper can be obtained free of charge from the Sel-Rex Corporation, Nutley 10, New Jersey.

"Roto-Finish Record," No. 5, issued by Roto-Finish Ltd. of 39 Park Street, London, W.1., is devoted to the dimensions, capacity and work load of parts of standard Roto-Finish barrels, and types and performance capabilities of various Roto-Finish media. A reprint is also issued by Roto-Finish Ltd. of an article by R. E. Earl on "Economies obtainable by barrel finishing."

* * *

Albright and Wilson (Mfg.) Ltd. of 1 Knightsbridge Green, London, S.W.1 have produced a booklet which lists in alphabetical order, together with the physical form and package capacity of the range of products available from their General Chemicals Department, which include industrial finishing compounds.

* * *

"Technical Notes," 212, published by CIBA (A.R.L.) of Duxford, Cambridge, is entirely devoted to a description of the construction of the "Bluebird" C.N.7., designed for the recent attempt on the world land speed record by Mr. Donald Campbell at Bonneville Salt Flats. The frame of the car is unique in that great dependence has been made on the use of synthetic-resin adhesives in the assembly and bonding of the main beams, auxiliary beams, engine covers, pressure bulkheads and canopy frame which consist of sandwich panels with aluminium alloy facing sheets and "Aeroweb" aluminium honeycomb stabilising cores.

* * *

Pamphlet No. 9, "Titanium Heating Coils," issued by the Metals Division of the Imperial Chemical Industries Ltd., Millbank, London, S.W.1. describes with illustrations how titanium heating coils help to solve an outstanding problem in the metal-finishing industry by the provision of an efficient and trouble-free heating system for chrome and nickel plating vats. Indications are that titanium coils have a useful life of ten or more years in chrome and nickel plating solutions.

* * *

Croda Ltd., Cowick Hall, Snaith, Goole, Yorkshire, have issued a technical bulletin on a strippable plastic coating, Crocell, which can be used as a transparent packaging material and can be applied by dipping to machine tools, gauges, drills, gear wheels, cylinder liners and other items to provide a contiguous flexible but tough abrasion-resistant, shock-absorbing coating, which can be removed immediately by slitting and peeling off.

Latest Developments in PLANT, PROCESSES AND EQUIPMENT

Portable Measuring Instrument for Coatings

THE East Lancashire Chemical Co. Ltd. of Fairfield, Manchester, have developed the Elcotector Mark II (Fig. 1) which is a battery-operated portable instrument designed to take measurements anywhere in the field or factory ; its primary use is for all types of coating measurements on components and is capable of measuring the thicknesses of most metallic and non-metallic foils both in the static and moving state. It can therefore be used in a production run to give continuous readings of thickness, hardness or other changes as material is produced. Other duties include surface detection, the comparison of hardness of steel components and the variation between different types of alloys.

Fig. 1.—Portable measuring instrument for coatings

Heated Hoses

HEATED Hoses Ltd., Egerton Lane, Sheffield 1, are producing two types of heated hoses, Heronflex and Evaflow, in a wide range of lengths and bores, in which the problem of maintaining liquids at flow and working temperatures throughout their lengths is overcome by using the metallic strengthening materials in the hose walls, instead of separate heating elements. Heronflex has two concentric metallic braidings which are connected at one end while the other ends are connected to the secondary winding of a mains transformer ; the current is of sufficiently low voltage to give no possible risk of shock ; the inner braiding is of high resistance steel and the outer braiding of copper so that a minimum of heat is lost. Evaflow has two concentric wire coils in the hose walls, the inner coil having a greater resistance than the outer so that a greater concentration of heat is applied at the inner surface of the hose.

Surface Treatment of Aluminium

THE Walterisation Co. Ltd. of Purley Way, Croydon, have produced surface treatments for aluminium, under the name of " Walterbryte," which provide a satin etch finish and offer a suitable pretreatment for a protective chemical oxidation process. There are two treatments, " Walterbryte H " (heavy) or " Walterbryte B " (light), both of which are immersion processes which give a bright satin or silver appearance and at the same time remove extrusion or other surface defects. The " H " process has been primarily designed as a heavy etching treatment to remove extrusion or draw marks ; the normal operating temperature is 50°C. and the immersion time is 5 minutes ; after processing, the work is rinsed in cold running water and then immersed in a de-smutting solution. The " B " process removes less metal and is more suitable for light etching and treatment of surfaces where it is necessary to remove the highlights from bright or polished aluminium ; the operating temperature is 30°C. and the immersion time 5 minutes.

The company have also developed a chromate conversion process, " Cromcote," which produces a chromate coating with a high corrosion resistance value and excellent paint-bonding properties. The coating has a very low electrical resistance so that it can be used for electrical equipment with little impedance of circuit-making. The coatings can vary in colour from almost colourless to a deep bronze with corrosion resistance generally increasing with depth of colour. The process is normally operated at room temperature (20° to 25°C.) and the immersion time is from 10 sec. to 5 min. depending upon the colour required. After immersion parts should be rinsed with cold running water followed by a hot rinse not greater than 70°C. and for not longer than 30 sec.

Portable Blast Cleaner

HODGE Clemco Ltd., New Road, Rainham, Essex, have produced a self-contained portable blast cleaning unit, the Educt-o-matic, (Fig. 2), weighing only seven pounds and containing its own vacuum pick-up and dust extraction unit. The only connexion required is an airline, which should be ¾-in. internal diameter, supplying 33 to 60 cu. ft. per min. at a pressure of 90 to 100 lb. per sq. in. The unit is particularly useful in areas where open blasting is impracticable and in plant maintenance where it can be used for cleaning surfaces prior to re-coating, and it is claimed that one-man operation with the Educt-o-matic is equivalent to three men cleaning by wire-brushing, disc-sanding or other hand cleaning methods.

Most common re-usable abrasives can be used such as steel shot and grit, aluminium oxide, silicon carbides and walnut shells of a mesh of 40 or finer. The abrasive is continually recirculated so that there is very little wastage and a full charge of four pounds will normally blast for 15 to 40 minutes. Compressed air sucks the abrasive from its container into a venturi-type nozzle which blasts the air/abrasive mixture perfectly evenly over the area enclosed by a rubber boot, giving a blast pattern of 1-in. to 1½-in. diameter ; a vacuum picks up the abrasive with the material blasted from the surface and passes them to a small cyclone where they are separated ; the removed material is then blown into a dust bag for later disposal.

Penton Spray Coating Technique

THE Pfaudler Co., a division of Pfaudler Permutit Inc., Rochester, New York, have introduced on a commercial basis, a sprayable coating of Penton in water-suspension. Pfaudlon 301, which can be applied to desired thickness (20 to 40 mils) with as few as two applications while four or more are commonly required when alternate methods are used.

Penton is a chlorinated polyether polymer developed by Hercules Powder Co., having almost universal resistance to corrosion at temperatures of 250° to 275° F. and claimed to have excellent resistance also to abrasion and impact damage. Pfaudlon 301 is applied in approximately the same manner as are organic suspensions but Pfaudler consider that the water-spraying technique is superior because elaborate safety measures are not needed to guard against toxicity and inflammability.

Three firms have been licensed to use the process — American Durafilm Co. in Boston, Mercer Rubber Co. in New York and Electrochemical Engineering and Manufacturing Co. of Emmaus, Pennsylvania ; it is expected that more firms will be licensed in the future.

Fig. 2.—Portable blast cleaner

Vinyl Protection Tape

VINYL protection tape has been developed by John Gosheron and Co. Ltd., Albert Embankment, Vauxhall, London, S.E.11., specifically for the protection of metal and plastic surfaces such as polished steels and aluminium, decorative and industrial laminates, and lacquered or painted metals. It is also suitable to protect anodized aluminium, porcelain, glass and some polished wood surfaces and costly materials which when marred accidentally by scratches, marks or scuffing are rendered unsatisfactory for sale.

Basically this protection tape is unplasticized vinyl transparent film possessing inherently good waterproofing and weatherproofing properties. The film is coated with a new synthetic adhesive which has long life, exceptional resistance to ageing effects of light over a period of six months or more and can be removed quite easily from all surfaces.

In addition to the incorporation of a vapour-phase inhibitor limiting the possibility of rusting on steel surfaces, inhibitors have been incorporated in the adhesive to restrict the corrosion of steel surfaces and to limit staining on copper and those materials and alloys which contain copper.

(*Continued in page* 416)

Shot-blasting Helmet

FIG. 3 illustrates the Saferhelm Mark II air-fed shot-blasting helmet which has been produced by Heafield Industries Ltd., of Spa Lane, Derby, as an improvement on the design of the Saferhelm helmet already introduced by them. The new helmet has a newly designed shell with the air-inlet at the rear, the aperture is larger and has an inner window which need not be replaced unless it is damaged ; the outer window consists of clear, tough P.V.C., drawn from a reel casette (patent applied for) over the aperture at the front.

Working trials, it is claimed, have proved this helmet to be far more efficient and time saving than any yet invented. This is because when the outer window becomes marked, the operator has only to pull down the next clear section of P.V.C. from the reel — instead of removing the whole outer window from its frame and fixing in a replacement.

Spools, which can be changed in a matter of seconds, are supplied complete with reels and contain enough P.V.C. for 8 new " windows " on every spool.

Fig. 3—Shot-blasting helmet

Non-Curing Liquid Adhesive

THE Rubber and Asbestos Corporation, Floomfield, New Jersey, U.S.A., the sole distributors in the U.K. for whom are Omni (London) Ltd., 35 Great Dover Street, London, W.1., have introduced in this country their latest adhesive, Bondmaster G. 523 Series, which, the makers say, is the most suitable adhesive for tank lining applications, especially the Polymer Penton tank linings. Bondmaster 523 is a high-bond-strength, non-curing, room-temperature-contact-bonding adhesive for rigid and semi-rigid materials such as decorative laminates, linoleum, metals and most plastics and is claimed to be exceptionally strong with good heat resistance. It has a storage life of at least one year and can be applied by brush, trowel, paint roller, flow gun or spray gun.

Bright Hard Gold Plating

SILVERCROWN Ltd., of 178-180, Goswell Road, London, E.C.1., are manufacturing and supplying bright hard gold plating processes in this country under an exclusive licence agreement with Technic Inc., Providence, Rhode Island, U.S.A. There are two grades — " Supersonic " Orosene Gold and " Superbrite " Gold (Non-free Cyanide) ; the former contains no silver and produces a fully-bright 24 carat gold plate with a minimum fine gold content of approx. 99.8 per cent, and the latter contains practically no free cyanide and produces a bright gold plate of 23½ carat plus ; both solutions are suitable for vat or barrel plating. Typical industrial applications are printed circuits, waveguides, contacts, electronic

Jig Insulation for Use With Solvent Driers

INCREASING use is being made of solvent drying as a means of removing water from articles which have been subjected to treatment in aqueous solutions. The process involves immersion in a hot chlorinated hydrocarbon solvent, *e.g.* trichlorethylene or perchlorethylene, containing an addition agent which acts as a water displacer.

While this drying process has undoubted advantages, difficulty has been encountered in the past because of the considerable damage which the solvent mixture inflicts on normal jig insulating coatings. This has necessitated the removal of work from coated jigs and its remounting on uncoated jigs before immersion in the solvent drier, a procedure which has tended to offset the economic advantages of the process.

One solution to the problem would appear to be to hand with the announcement by John Preston and Co. Ltd., Sarsfield Road, Perivale, Greenford, Middlesex, of a new jig insulating compound, marketed under the name Prestoncote Red, for which is claimed complete resistance to the action of those solvent driers in present use, as well as, of course, to the solutions used in normal metal-finishing practice.

(*Continued in page* 418)

Polethylene Ball Chroffles for Plating and Pickling Baths

W. CANNING and Co. Ltd., are now marketing ball chroffles made from Rigidex high density polyethylene. These rigid chroffles are spherical in shape, diameter approximately 1¾in., and are supplied for use in plating and pickling tanks, where they float on the surface of the liquid and form an inert blanket. This blanket minimises spray and splashing of dangerous or objectionable solutions, which reduces busbar and ducting corrosion and provides an additional safeguard for plating shop staff.

The chroffles also reduce heat losses from the surface of the bath and can save as much as 12 per cent. of the heating normally required. Fan exhaust can be reduced and in some cases dispensed with, and this results in appreciable saving

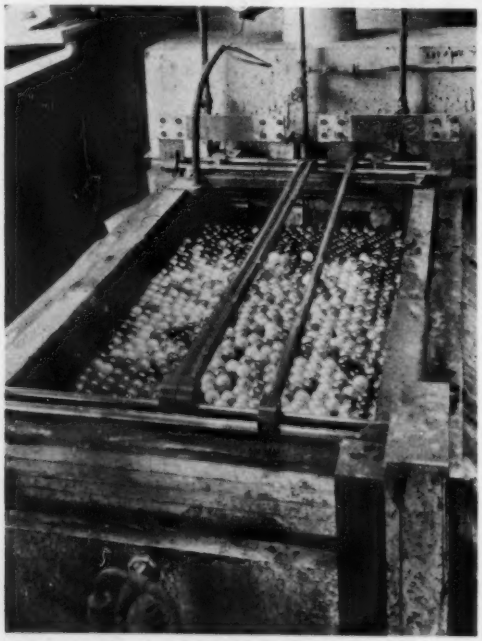

Fig. 4.—Ball chroffles for plating

in space heating. A further advantage is that the use of chroffles reduces the cleaning and maintenance of exhaust systems, busbars and jigs, with a consequent saving in time and labour.

Due to their shape, ball chroffles "take up" uneven contours or projections on the articles being processed and thus maintain uniform coverage of the solution. Chroffles made from Rigidex are suitable for temperatures of up to 200°F. and are resistant to most acids and alkalis. They are also resistant to oils and are being evaluated as a seal for oil storage tanks to prevent losses due to evaporation.

The chroffles are blow-moulded for Cannings by Lacrinoid Products Ltd.

P.V.C. Counter Topping

THE Goodyear Tyre and Rubber Co. (Great Britain) Ltd. of 36, Buckingham Gate, London, S.W.1., have introduced into this country "Evergleam," a polyvinyl chloride counter-topping which has been developed and proved successful in the United States. It is produced in four designs, linen, frost, metallic and terrazzo, and is claimed to be resistant to water, grease, acids, alkalies, heat and abrasion. It can be applied to metals by using the usual type of adhesive and, being pliable, readily conforms to uneven and irregular surfaces, without splitting or cracking. It is supplied in 38-yard rolls of 27 in. and 36 in. widths and 25-yard rolls of 45 in. width.

Pocket *p*H Meter

THE Cambridge Instrument Co. Ltd., of 13, Grosvenor Place, London, S.W.1., have marketed a pocket pH meter weighing less than 3lb. covering the whole range from 0 to 14 units, and calibrated in divisions of 0.2 pH. Accuracy is ±0.1pH and the reference and measuring electrodes are combined into a single concentric unit which is not seriously affected by the presence of sodium ions in the range above 10 pH. The instrument is powered by dry cell batteries with a life of approximately 1,000 hours and can be supplied with a carrying case, fitted with a plasticc shoulder strap.

The case has an extra compartment for the electrode and buffer solutions. It is suitable for pH measurements and electro-titrations in the laboratory, or for industrial use by technicians who have to move from place to place.

Paint Stripper

THE Magnus Chemical Co. Ltd., Salisbury Road, Trading Estate, Uxbridge, Middlesex, have produced a solvent compound, Magnus 701-M, for cold paint stripping and the removal of residues from rubber matrices as well as carbonized fuel and oil residues from diesel, locomotive and other components. Controlled tests indicate that it will deal satisfactorily with many of the newer paints, including the latest types of epikote paints. The compound should be used at room temperature and should not be heated ; as it contains its own seal, water additions are unnecessary.

(*Continued in advt. page* 28)

Plant, Processes and Equipment

(*Continued from page* 418)

Zinc Primer

DETEL Products Ltd., of Stonefield Way, Victoria Road, South Ruislip, Middlesex, have produced a new type of zinc primer which can be used with equal effect in either hot or cold weather and requires only a quick stir before use as with normal paints, distinct from the usual type of zinc primer supplied in the form of a stiff paste which requires the addition of thinners and a considerable amount of stirring before use. The coverage is from 400 to 500 sq. ft. per gallon and the primer is quick-drying. It can be stoved for quick handling for 20 minutes at 160°F. and is heat resistant in water up to 160°F. and in dry heat up to approximately 300°F.

Polishing Compound Remover

SILVERCROWN Ltd., 178/180 Goswell Road, London, E.C.1., produce a synthetic detergent specifically for removing polishing compounds by soak cleaning from all metals and plastics. "Composol" is water-soluble and is particularly effective on stubborn compounds which have aged overnight and weekends and readily removes compound from aluminium and zinc which have combined to form metallic soaps. Ferrous parts treated with "Composol" also have a tendency to resist rusting.

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Prepaid rates: FIFTEEN WORDS for 7s 6d. (minimum charge) and 4d. per word thereafter, or 24s. per inch. Box number 2s. 6d. including postage of replies.

SITUATIONS VACANT

CHEMIST is required to take charge of Control Laboratory of large Nickel/Chromium Plating Plant near Cardiff commencing 1st January 1961. Graduate of H.N.C. or similar qualification preferably with some experience of plating required. Send full details stating age, qualifications and salary required to Box CH234 METAL FINISHING JOURNAL.

MACHINERY FOR SALE

ONE INFRA RED GAS FIRED TUNNEL TYPE OVEN. 12 Parkinson Cowan type panels, 3 ft. x 18 in. with lighting controls and necessary indicator gauges. Overall size 8 ft. length x 7 ft. height x 5 ft. width. In perfect condition. First reasonable offer. Newton Plating Jigs and Insulations Ltd., ACO 6157.

BRAND NEW HOT DIP TINNING PLANT (unused), gas heated, comprising sequence of eleven tanks. Pickle tanks 6 ft. 6 ins. x 3 ft. x 3 ft. Tinning baths 3 ft. 6 ins. x 2 ft. x 1 ft. 6 ins., for disposal at sacrifice owing to change of plans. Apply Box FS 233 METAL FINISHING JOURNAL.

BAKER BRIGHT SILVER PROCESS

- Deposits are hard and highly ductile and provide a mirror bright finish.
- Brighteners completely stable with no deleterious decomposition products.
- Non-critical, economical operation and control.

The special features accomplished by the Baker 'Silva-Brite' Plating process include the following :

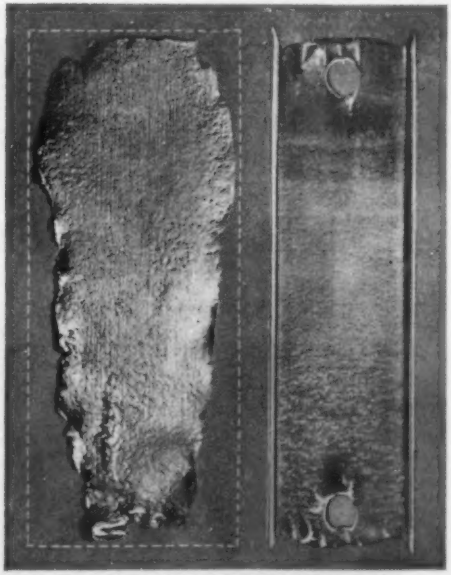
- The clear, water-white solution enables the plater to watch work in the process of being plated.
- The solution possesses excellent throwing power.
- Room temperature operation.

'DOG-BONE' SHAPED SILVER ANODES

The 'Dog-Bone' cross-section ensures uniform dissolution throughout the life of the anode. Anodes of this type compare very favourably against conventional sheet anodes. For instance, when both types of anode have been operated under similar conditions, until only 15 per cent of their original weight remains, the loss of surface area is approximately three times greater for the conventional sheet anode than for the 'Dog-Bone' anode. This even dissolution eliminates anode 'shedding' and gives smoother deposits free from roughness.

'Dog-Bone' is a registered trade mark.

Leaflet giving further information is available on request.



Comparison of conventional and 'Dog-Bone' anodes after identical weight loss illustrating high retention of surface area of the Baker 'Dog-Bone' anode.

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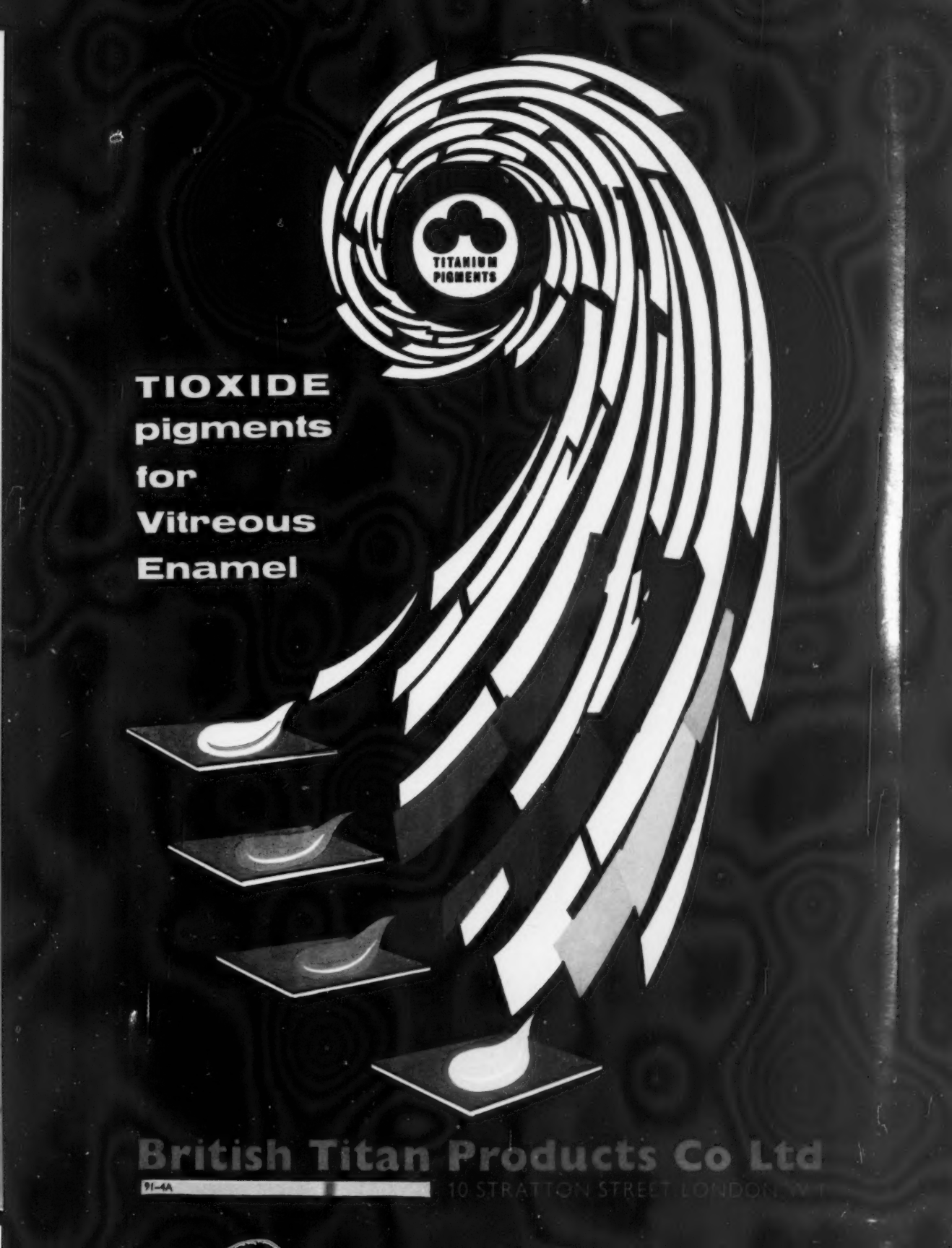
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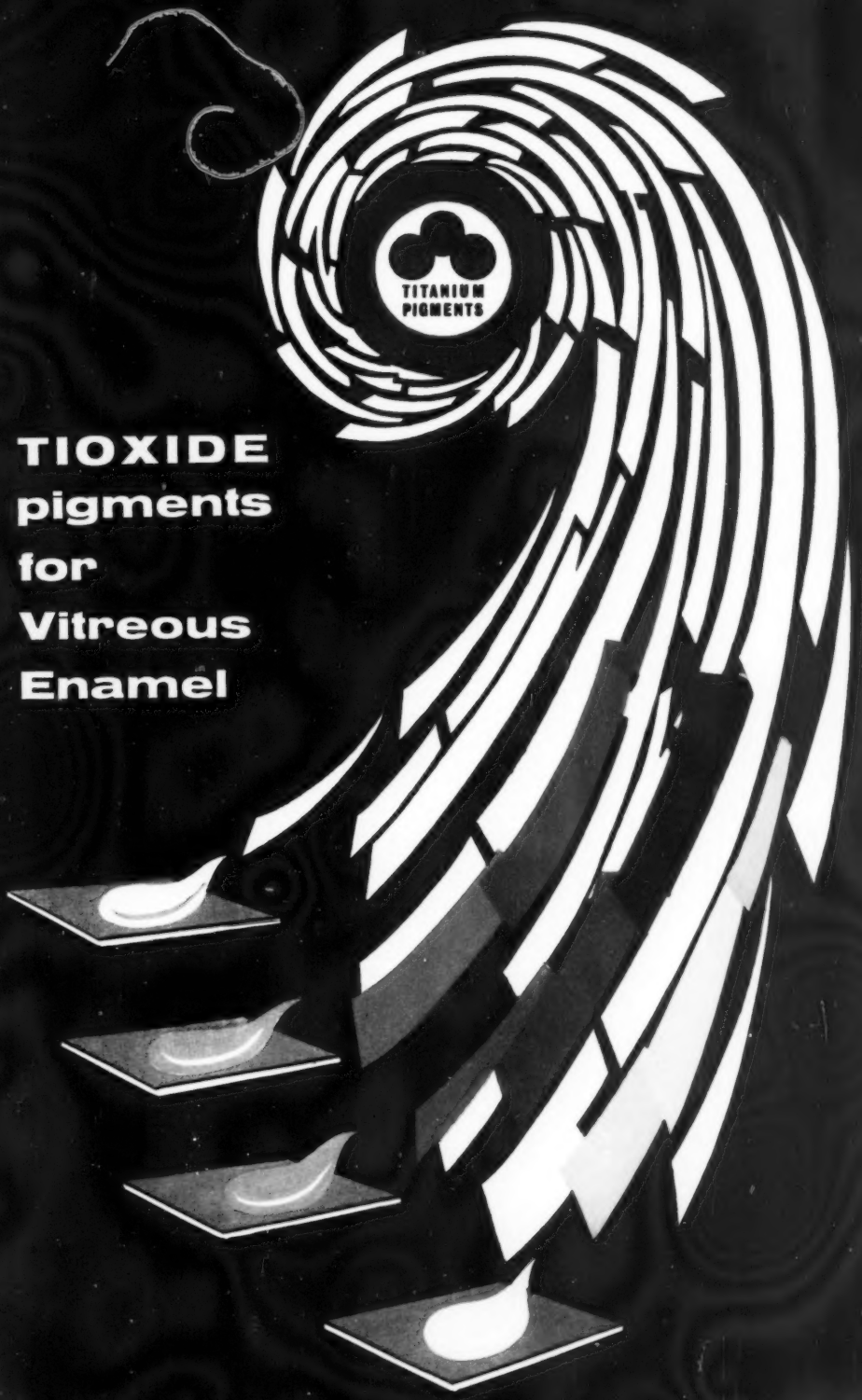

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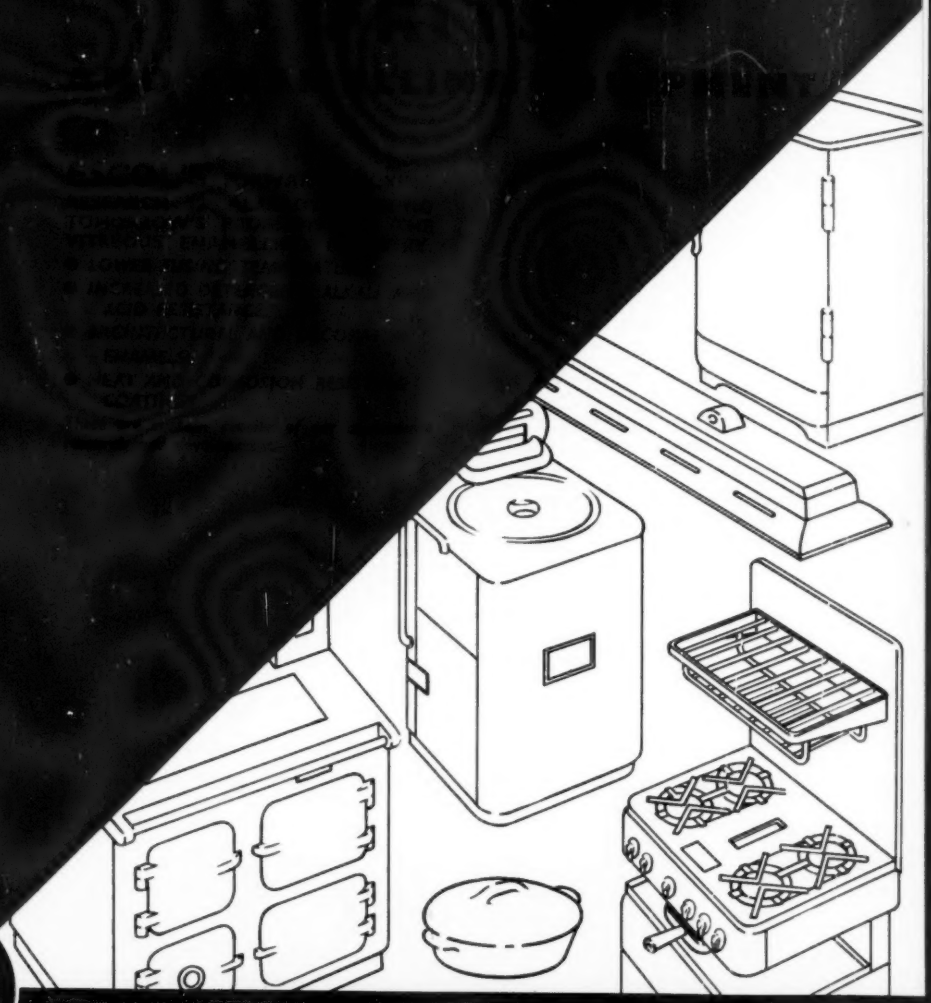

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